Silviculture Specialist Report

Big Jack East Project

Tahoe National Forest

Truckee Ranger District

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TABLE OF CONTENTS

AFFECTED ENVIRONMENT AND CURRENT CONDITIONS

Project Area

The Big Jack East Project Area is approximately 2059 acres in size and is located within a Wildland Urban Interface (WUI) adjacent to the communities of: Sierra Meadows, Ponderosa Palisades, Martis Woods Estates, Ponderosa Ranchos, and Martis Camp. Additionally, a major utility corridor runs through the project area. Given these values at risk, management action is necessitated to mitigate fire related risks in accordance to the Forest Plan (*Tahoe National Forest Land and Resource Management Plan* (LRMP 1990) as amended by the *Sierra Nevada Forest Plan Amendment Record of Decision* (SNFPA ROD 2004)).

The Big Jack East Project area is divided into two zones, the Threat Zone (TZ) and the Defense Zone (DZ). The DZ is roughly defined as a ¼ mile buffer around communities, areas with higher densities of residences, commercial buildings, and/or administrative sites with facilities. This DZ composes the northern and eastern boundaries of the project area. The TZ was delineated by Forest Fire and Fuels Staff to be an area which extends 1 ¼ miles beyond the DZ.

This Project area is composed of 26 separate treatment units. Some of these blocks are part of both the Threat Zone and the Defense Zone. These treatment units will be utilized as the divisions in which the project area will be analyzed for this document.

Vegetation

The current vegetation is composed of a mix of Jeffrey Pine (*pinus jeffreyi*), sugar pine (*pinus lambertiana*) , lodgepole pine (*pinus contorta*), white fir (*abies concolor*), and red fir (*abies magnifica*). The project area is dominated by Jeffrey pine while white fir is a secondary dominant species. Lodgepole pine is dominant in three treatment block and a minor component to absent in others. The sugar pine and red fir are very minor to absent within the project area.

The Cal Veg classification for the Big Jack East Project area is the Eastside Pine Alliance.

The Project area is generally overstocked in terms of tree densities. Approximately 10% of the 2,059 acres may be considered understocked, with basal areas no greater than 80 ft² per acre. The remainder is comprised of overstocked stands with basal areas ranging from 120-230 ft² per acre. The average basal area for the entire project area is approximately 150 ft² per acre. Overstories are generally dominated by Jeffrey pine and, to a lesser extent, white fir. However, lodgepole pine is minor component to dominant in the overstory in some units.

Structurally, this Project area is dominated by uneven aged stands (>90% of area), the remainder are generally single storied or two aged stands dominated by smaller (<20 DBH) trees.

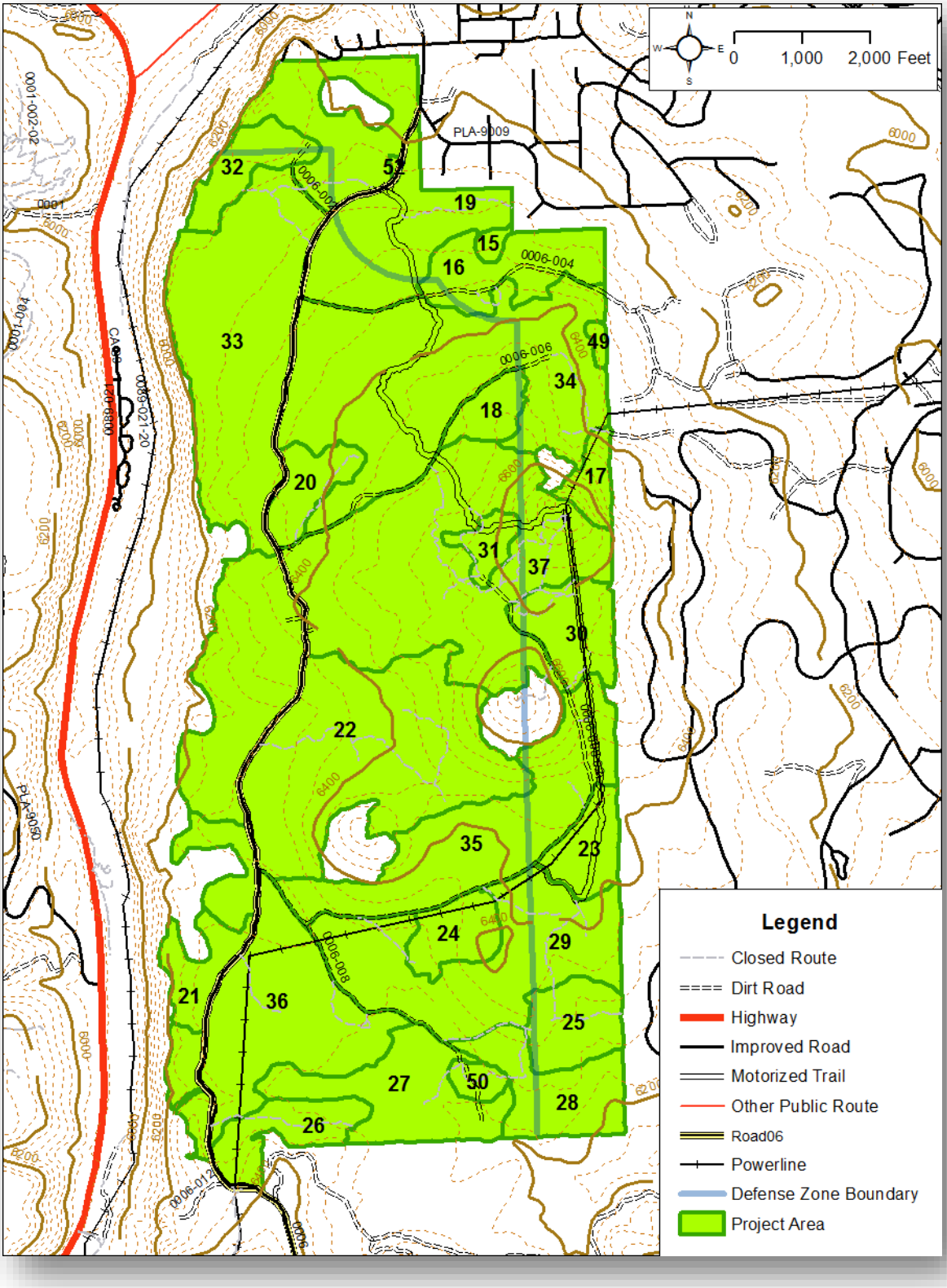

Figure 1. Big Jack East Project Area

Figure 2. Uneven-Aged Structure

Forest Health

Several issues related to forest health threaten the stands of the Big Jack East Project area, both biotic and abiotic. Among the biotic threats are: dwarf mistletoe (*Arceuthobium* spp.), fir engraver (*Scolytus ventralis*), Jeffrey pine beetle (*Dendroctonus jeffreyi*), mountain pine beetle (*Dendroctonus ponderosae*), root disease (*Heterobasidion annosum*), and white pine blister rust (*Cronartium ribicola*) (Krist et al. 2014). Currently, there are no major infections or infestation. However, dwarf mistletoes and bark beetles can be found within the project area. The remaining threats are found within the geographic area and my pose a more serious threat in the future.

The main forest health issues related to the stands within this project area relate to drought and competition induced stress. Based upon the stand density index (a unitless measure of stocking), approximately 67% of the project area can be considered to be of high to extremely high density. High stand densities indicate full site occupancy, active completion among trees, declining diameter growth. Once a stand moves into the extremely high density, density based completion induced mortality begins and individual tree growth is minimal to stagnant. Mortality in overstocked high and extremely high density stands can be further exacerbated once drought makes water even more limiting resource.

Competition induced stress and drought can also further enhance the vulnerability of a stand to insects and disease and, ultimately, mortality. In the most general sense, lack of water limits an individual trees ability to resist bark beetle attack (Vose et al. 2016).

SILVICULTURE GOALS

Three “Needs” have been established as the driving force for the Big Jack East Project. These three are:

1. Action is needed to reduce fuel loadings and create a safer, more effective fire suppression environment in the wildland urban intermix.

2. Action is needed to create conditions that would improve forest stands' resiliency to fire, insects, disease, drought, and climate change
3. Limited changes to the National Forest Transportation System are needed to protect sensitive resources, provide access for vegetation and fuels management, utility site management, and a recreation opportunity as well as to mitigate fire risk and sanitation issues

Of these three "Needs", #1 and #2 are silviculturally related. From these "Needs" the following Goals and objectives are derived.

- Goal #1: Reduction of Fire Risk
    - Objective A: Reduction fuel loadings
    - Objective B: Improvement of effectiveness of fire suppression
    - Objective C: Create defensible space near communities
- Goal #2: Improvement of Resiliency and Resistance
    - Objective A: Insect and disease
    - Objective B: Fire
    - Objective C: Drought and climate change

Reduction of Fire Risk

The Goal of Reduction of Fire Risk relates to the improvement of fire suppression activities, mitigation of stand replacing fire, and the protection of communities which are adjacent to the project area. For the purpose of this report, this three management objectives have been derived from this Goal.

Reduction of Fuel Loadings

Fuel loadings within the project area can be divided into three basic categories: surface fuels, ladder fuels, and canopy fuels. Surface fuels include the dead and downed coarse woody material and well as duff and litter which allow for surface fires to spread. Ladder fuels are the small trees which allow for surface fires to reach the overstory canopy. Canopy fuels are crowns of the overstory which allow for crown fires to spread. In order to mitigate fire risk these fuels are to be reduced.

Surface fuels would be reduced though various management methods including, but not limited to; mastication, piling and burning, and prescribed broadcast burn activities. Ladder fuels would be reduced through; thinning (hand and mechanical), mastication, and prescribed broadcast burn activities. The canopy fuels would be reduced through mechanical thinning activities.

Improvement of Effectiveness of Fire Suppression

In order to improve the effectiveness of fire suppression activities, fuel breaks and openings would need to be established in which fire suppression activities can be staged. The 06 Road, also known as the Sawtooth Road, had been established as a fuel break approximately 25 years ago. Since this establishment, this fuel break has become revegetated and no longer offers the opportunities for fire suppression and activity staging as it once has. Additional opportunities for fire suppression can be realized though retaining trees in groups or clumps (see Variable Density Thinning (VDT) and the creation of openings (see Create Openings (CO)) within the forested areas. Thinning to a groupy/clumpy horizontal structure would establish gaps between groups or clumps which are, generally, isolated from other clumps. This would reduce the risk of active crown fire and provide additional opportunities for fire suppression. The creation of openings would establish, through harvest activities, areas of various sizes (0.1-1.25 acres) where all trees have been removed with the exception of those larger than the established diameter cap of 29.9 acres. This, also, would reduce risk of active crown fire and provide additional opportunities for fire suppression activities.

Creation of Defensible Space near Communities

Given that the northern and eastern boundary of Big Jack East project area is adjacent to several communities, additional efforts would be necessary to provide protection from fire related threats. The establishment of the Defense Zone within a quarter mile of the edge of National Forest System lands and the private property line would need specific silvicultural treatments in order to further mitigate any risk of wildfire from traveling from national forest lands onto private lands as well as fire spreading from private lands onto national forest lands. Treatment of fuels within this DZ would be employed to mitigate this threat.

Improvement of Resiliency and Resistance

Insects and Disease

The known insects and disease agents that pose a current and potential threat to the stands within the Big Jack East project area include: dwarf mistletoe, fir engraver, Jeffrey pine beetle, mountain pine beetle, root disease, and white pine blister rust. The following describes management strategies for the current and potential insects and disease within the project area

Dwarf Mistletoes

Dwarf mistletoe is currently minor within the project area. Dwarf mistletoe can cause reduced growth, mortality, vulnerability to other agents, susceptibility to fire, and diminished seed production. Dwarf mistletoe infections can be managed through sanitation harvest, thinning to outgrow the infection (small vigorous trees with light infections), promoting non-host species, altering stand structure to mitigate spread of infection, non-host buffers to mitigate spread, and infection pruning (Scharpf et al. 1988). Given the current infection levels and the large project area, sanitation would be the primary method to mitigate dwarf mistletoe infections. Secondary method for managing dwarf mistletoe within the project area would be the favoring of non-host species in areas where sanitation is not acceptable, such are trees larger than the established diameter cap of 29.9".

Fir Engraver

The Big Jack project area is within the range of the fir engraver whose primary hosts include the white fir and red fir. In addition to live trees, the fir engraver can also infest fresh logs. Fir engraver bore into boles of trees in areas, generally, greater than 4" in diameter and brood. Vigorous firs may "pitch out" attacking fir engravers. Attacks may kill the upper crown or entire tree within one summer and "flagging" may become evident within 3 to 6 months after attack. The fir engraver may take 1 to 2 years to complete its life cycle, depending on temperature of the site. Management for fir engraver includes sanitation and thinning to promote health and vigor (Ferrell 1986).

Bark Beetles

In terms of bark beetles (*Dendroctonus* ssp.) the mountain pine beetle and Jeffrey pine beetle pose the most serious threat to the Big Jack East Project area. Relatively minor and isolated bark beetle activity has been found within the project area, however this may change as in the future. The Jeffrey pine beetle's host is the Jeffrey pine while the mountain pine beetle's hosts include the lodgepole and sugar pine. Both species attack individual trees or groups of trees and, generally, prefer trees which have been subject to injury, competition induced stress, and effects from other pathogens (Gibson et al 2009 and Smith et al. 2009). Periods of drought can further enhance Jeffrey pine beetle induced mortality (Smith et al. 2009). Strategies for the preventing bark beetle outbreak generally include sanitation of infected individuals and thinning to improve health and vigor.

Root Disease

The annosus root disease infections primarily result in stem and root decay, and root mortality. Secondary effects include diminished vigor, windthrow, vulnerability to bark beetles, and mortality. There are two different

biological species of *Heterobasidion annosum*, the "P-group" and the "S-group". The P-group infects pines, incense-cedar, western juniper, pinyon and manzanita. The S-group infects true firs, giant sequoia, Douglas-fir, and hemlock. Annosus mortality in true fir is greatest in stands where fir basal area is in excess of 26 ft² per acre, total stand basal area is greater than 100 ft² per acre, stand age is more than 120 years, and partial cuts have occurred (Schmitt et al 2000). In pines, annosus impacts are, generally, greatest on poor and dry sites. Silviculturally based prevention methods include minimalizing partial cuts in fir stands, prevention of wounding of retained trees, minimizing site disturbance, and promoting pines over fir trees (Schmitt et al 2000). Chemically based prevention methods include the application of a borate product registered for annosus control. The borate product should be applied on freshly cut stumps of 12 or more inches for chainsaw felling and 8 inches or greater for shearer felled trees (Schmitt et al. 2000).

White Pine Blister Rust

The white pine blister rust fungus may pose a threat to the sugar pine found in the Big Jack project area. The alternate hose for the fungus is the plants of the *Ribes* genus. Blister rust cankers kill tress by girdling (large bole cankers) or through defoliation (limb and twig cankers) (Miller et al. 1959). Sugar pine trees exhibiting resistance should not be thinned or harvested.

Fire

In order to promote resilience of the stands within the Big Jack project area to fire it is necessary to promote fire tolerant trees over those that are not fire tolerant. The Jeffrey pine and the sugar pine are the more fire tolerant trees species within the project area while the red fir, lodgepole pine, and white fir are the fire intolerant species. In order to order to promote stands which are resilient to fire, Jeffrey pine and sugar pine should be favored for retention over other tree species found within the project area.

Drought

Drought can increase a plant's vulnerability to insects and disease. Foliage based effects include reduced needle retention and diminished needle elongation. Drought can also cause mortality, especially in small trees. The effects of drought can be mitigated through the control of stocking to maintain health and vigor (Vole et al. 2016).

Climate Change

The USDA Forest Service has produced guidance for adapting to climate change in document "Forest Adaptation Resources: Climate Change Tools and Approaches for Land Managers, 2nd Edition" (Swanston et al. 2016). The following table (Table 3.) is a brief synthesis of strategies, related to Silviculture and the Big Jack East project, in which would be employed in terms of managing for resilience to climate change.

Table 1. Climate Change Strategies

Strategy	Approach	Management Method
Sustain Fundamental Ecological Function (pg. 36)	Reduce competition for moisture, nutrients, and light (pg. 38)	Thinning to reduce competition
	Restore or maintain fire in fire-adapted ecosystems (pg. 38)	Favoring fire tolerant trees species
Reduce the Impact of Biological Stressors (pg. 39)	Maintain or improve the ability of forests to resist pests and pathogens (pg. 39)	Thinning to improve health and vigor of trees and stands

Reduce the risk and long-term impacts of severe disturbances (pg. 41)	Alter forest structure or composition to reduce risk or severity of wildfire (pg. 41)	Reduce contiguous canopy fuels layer and ladder fuels
	Establish fuel breaks to slow the spread of catastrophic fire (pg. 41)	Re-establish Sawtooth Road fuel break
Maintain and Enhance Species and Structural Diversity (pg. 44)	Promote diverse age classes (pg. 44)	Maintain uneven-aged structure
	Maintain and restore diversity of native species (pg. 45)	Maintain species diversity of all tree species found in project area
	Retain biological legacies (pg. 45)	Maintain large trees within project area

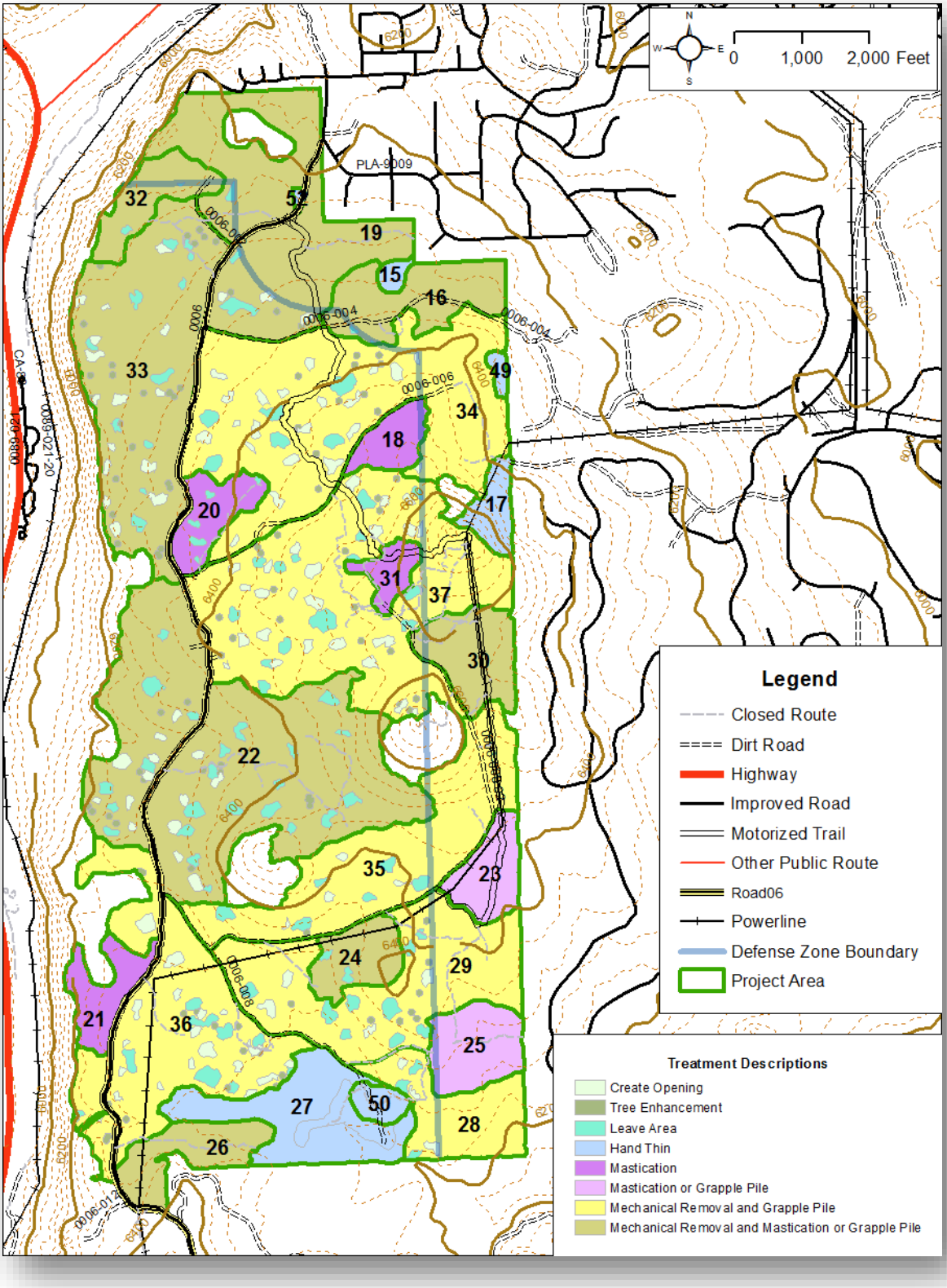

Figure 3. Special Treatment Areas and Treatment Methods

ALTERNATIVES ANALYZED IN DETAIL

Alternative 1: Proposed Action

Treatment Objectives

Treatments are intended to reduce fuel loading and competition within the Big Jack East Project Area. Vegetation treatments will focus on the improvement of stand health and vigor, the reduction of resource completion, and the reduction of the continuity of vertical and horizontal fuel layers (fuel ladders and contiguous canopy layer). Fuels treatments will reduce or remove existing coarse woody debris in addition to activity based fuels produced from the vegetation treatments.

Treatment Prescriptions and Methods

The Big Jack East Project Area is divided into two zones: Defensive Zone and Threat Zone. Furthermore, the project area is broken into 26 treatment units, some of which are in both Defense Zone and Threat Zone. Table 4 identifies these units and treatments.

Table 2. Big Jack East Treatment Units

Unit Number	Total Unit Acres	Defense or Threat zone Treatment	Zone Acres	Vegetation Management Tools	Surface Fuel Management Tools	Variable Density Thin Acres	Tree Enhancement Acres	Create Opening Acres	Leave Area Acres
15	4.4	Defense Zone	4.4	Hand Thin	Pile Burn	N/A			
		Threat Zone	0.0	N/A					
16	52.0	Defense Zone	48.1	Mechanical Removal and Mastication or Grapple Pile	Landing Pile Burn or Remove, Pile Burn	N/A			
		Threat Zone	3.9	Mechanical Removal and Mastication or Grapple Pile	Landing Pile Burn or Remove, Pile Burn	3.6	0.0	0.0	0.3
17	16.4	Defense Zone	16.4	Hand Thin	Pile Burn	N/A			
		Threat Zone	0.0	N/A					
18	19.5	Defense Zone	1.3	Mastication	Jackpot Burn and Underburn	N/A			
		Threat Zone	18.2	Mastication	Jackpot Burn and Underburn	18.2	0.0	0.0	0.0
19	165.2	Defense Zone	127.4	Mechanical Removal and Mastication or Grapple Pile	Landing Pile Burn or Remove, Pile Burn	N/A			

Unit Number	Total Unit Acres	Defense or Threat zone Treatment	Zone Acres	Vegetation Management Tools	Surface Fuel Management Tools	Variable Density Thin Acres	Tree Enhancement Acres	Create Opening Acres	Leave Area Acres
		Threat Zone	37.7	Mechanical Removal and Mastication or Grapple Pile	Landing Pile Burn or Remove, Pile Burn	32.9	0.5	1.5	2.8
20	27.2	Defense Zone	0.0	N/A					
		Threat Zone	27.2	Mastication	Jackpot Burn and Underburn	25.6	0.0	0.0	1.6
21	27.1	Defense Zone	0.0	N/A	N/A	N/A			
		Threat Zone	27.1	Mastication	Jackpot Burn and Underburn	27.1	0.0	0.0	0.0
22	300.7	Defense Zone	0.7	Mechanical Removal and Mastication or Grapple Pile	Landing Pile Burn or Remove, Pile Burn	N/A			
		Threat Zone	300.0	Mechanical Removal and Mastication or Grapple Pile	Landing Pile Burn or Remove, Pile Burn Remove, Pile Burn	274.4	2.5	7.1	15.9
23	28.5	Defense Zone	28.5	Mastication or Grapple Pile	Pile Burn	N/A			
		Threat Zone	0.0	N/A					
24	28.5	Defense Zone	0.0	N/A					
		Threat Zone	28.5	Mechanical Removal and Mastication or Grapple Pile	Landing Pile Burn or Remove, Pile Burn	27.4	0.0	0.0	1.1
25	37.2	Defense Zone	35.0	Mastication or Grapple Pile	Pile Burn	N/A			
		Threat Zone	2.2	Mastication or Grapple Pile	Pile Burn	2.2	0.0	0.0	0.0
26	36.9	Defense Zone	0.0	N/A					
		Threat Zone	36.9	Mechanical Removal and Mastication or Grapple Pile	Landing Pile Burn or Remove, Pile Burn	36.9	0.0	0.0	0.0
27	73.3	Defense Zone	0.0	N/A					

Unit Number	Total Unit Acres	Defense or Threat zone Treatment	Zone Acres	Vegetation Management Tools	Surface Fuel Management Tools	Variable Density Thin Acres	Tree Enhancement Acres	Create Opening Acres	Leave Area Acres
		Threat Zone	73.3	Hand Thin	Pile Burn	73.3	0.0	0.0	0.0
28	53.2	Defense Zone	31.6	Mechanical Removal, Grapple Pile	Landing Pile Burn or Remove	N/A			
		Threat Zone	21.6	Mechanical Removal, Grapple Pile	Landing Pile Burn or Remove, Pile Burn	18.3	0.0	1.4	1.9
29	137.9	Defense Zone	44.2	Mechanical Removal, Grapple Pile	Landing Pile Burn or Remove, Pile Burn	N/A			
		Threat Zone	93.7	Mechanical Removal, Grapple Pile	Landing Pile Burn or Remove, Pile Burn	81.6	1.4	2.9	7.7
30	40.3	Defense Zone	38.3	Mechanical Removal and Mastication or Grapple Pile	Landing Pile Burn or Remove, Pile Burn	N/A			
		Threat Zone	2.0	Mechanical Removal and Mastication or Grapple Pile	Landing Pile Burn or Remove, Pile Burn	2.0	0.0	0.0	0.0
31	14.1	Defense Zone	0.0	N/A					
		Threat Zone	14.1	Mastication	Jackpot Burn and Underburn	14.1	0.0	0.0	0.0
32	30.9	Defense Zone	10.4	Mechanical Removal and Mastication or Grapple Pile	Landing Pile Burn or Remove, Pile Burn	N/A			
		Threat Zone	20.5	Mechanical Removal and Mastication or Grapple Pile	Landing Pile Burn or Remove, Pile Burn	20.1	0.0	0.0	0.4
33	180.4	Defense Zone	0.0	N/A					
		Threat Zone	180.4	Mechanical Removal and Mastication or Grapple Pile	Landing Pile Burn or Remove, Pile Burn	163.2	4.3	7.4	5.5
34	236.5	Defense Zone	71.0	Mechanical Removal, Grapple Pile	Landing Pile Burn or Remove, Pile Burn	N/A			

Unit Number	Total Unit Acres	Defense or Threat zone Treatment	Zone Acres	Vegetation Management Tools	Surface Fuel Management Tools	Variable Density Thin Acres	Tree Enhancement Acres	Create Opening Acres	Leave Area Acres
		Threat Zone	165.5	Mechanical Removal, Grapple Pile	Landing Pile Burn or Remove, Pile Burn	145.5	1.9	10.3	7.8
35	130.6	Defense Zone	51.1	Mechanical Removal, Grapple Pile	Landing Pile Burn or Remove, Pile Burn	N/A			
		Threat Zone	79.5	Mechanical Removal, Grapple Pile	Landing Pile Burn or Remove, Pile Burn	73.2	0.2	1.2	4.9
36	164.7	Defense Zone	0.0	N/A					
		Threat Zone	164.7	Mechanical Removal, Grapple Pile	Landing Pile Burn or Remove, Pile Burn	145.4	2.4	9.2	7.7
37	239.7	Defense Zone	45.2	Mechanical Removal, Grapple Pile	Landing Pile Burn or Remove, Pile Burn	N/A			
		Threat Zone	194.5	Mechanical Removal, Grapple Pile	Landing Pile Burn or Remove, Pile Burn	168.5	3.1	12.6	10.2
49	3.5	Defense Zone	3.5	Hand Thin	Pile Burn	N/A			
		Threat Zone	0.0	N/A					
50	9.3	Defense Zone	0.0	N/A					
		Threat Zone	9.3	Hand Thin	Pile Burn	9.3	0.0	0.0	0.0
52	1.1	Defense Zone	1.1	Hand Thin	Pile Burn	N/A			
		Threat Zone	0.0	N/A					
Totals	**2059.2**		**2059.1**		**Totals**	**1562.6**	**16.4**	**53.6**	**68.0**

Defense Zone

Description

The wildland urban intermix zone (WUI) is an area where human habitation is mixed with areas of flammable wildland vegetation. It extends out from the edge of developed private land into Federal, private, and State jurisdictions. The WUI is comprised of two zones: the defense zone and the threat zone.

The WUI defense zone is the buffer in closest proximity to communities, areas with higher densities of residences, commercial buildings, and/or administrative sites with facilities. Defense zones generally extend roughly ¼ mile out from these areas; however, actual defense zone boundaries are determined at the project level following national, regional and forest policy. In particular, the Healthy Forest Restoration Act of 2003 identifies areas to be included in the WUI. Local fire management specialists determine the extent, treatment orientation, and prescriptions for the WUI based on historical fire spread and intensity, historical weather patterns, topography, access. Defense zones should be of sufficient extent that fuel treatments within them will reduce wildland fire spread and intensity sufficiently for suppression forces to succeed in protecting human life and property. (SNFPA ROD, pg. 40).

Management Direction for Defense Zones

Desired Conditions

- Stands in defense zones are fairly open and dominated primarily by larger, fire tolerant trees
- The openness and discontinuity of crown fuels, both horizontally and vertically, result in very low probability of sustained crown fire and when effectively treated provide a safer place to protect structures in adjacent lands.
- Surface and ladder fuel conditions are such that crown fire ignition is highly unlikely
    - Ladder fuels are the vegetative fuel (small trees and shrubs) which provide vertical continuity between the ground surface and the forest canopy
    - Surface fuels are the vegetative fuel on or near the ground surface, consisting of leaf and needle litter, grass, dead branch material, downed logs, bark, pine cones and low growing vegetation

Treatments

Vegetation and fuels management treatments within the defense zone would be designed as follows. A fuel break, approximately ¼-mile wide, would be created or maintained along the northern and eastern private property boundaries of the project area using the following defense zone treatment parameters. The exact boundary is determined by fuels professionals and based on aspect, terrain, and basal conditions. The ¼ mile fuel break was determined to be sufficient by the district fuels and fire staff as well as following guidelines from the 2004 Forest Plan. The defense zone treatment would remove ladder fuels, surface fuels and space residual trees to provide crown separation and improve the health and vigor of these stands using thinning or other vegetation management tools.

Within the Mechanically Removal units, trees less than 29.9” DBH would be removed until the desired crown spacing is reached to meet fuels management goals. Trees should be spaced so the canopy of the larger trees would not support a sustained crown fire. Ladder fuels would be removed to keep fire from reaching the crowns of the larger trees. Post-treatment basal areas are anticipated to be approximately 80 to 100 ft^2 per acre. Treatment would retain the healthiest trees in the following order of priority, based primarily on shade tolerance and fire resistance: sugar pine, ponderosa pine/Jeffrey pine, lodgepole pine and white fir.

Within the Hand Thin units, trees less than 11” DBH would be removed. Spacing within these units are to be on a rough 20’ by 20’ spacing, allowing for variability and for fuel management goals. Treatment would retain the healthiest trees in the following order of priority, based primarily on shade tolerance and fire resistance: sugar pine, ponderosa pine/Jeffrey pine, lodgepole pine and white fir.

After the vegetation treatment, fuels management treatments would treat the residual and existing surface fuels to accomplish desired conditions and consistency with Forest Plan. The vegetation management and surface fuel

management tools used to accomplish these treatments are displayed on a site-specific level in Table 4 above. The 'Implementation Tools' section below provides technical details about each tool.

Threat Zone

Description

The WUI threat zone typically buffers the defense zone; however, a threat zone may be delineated in the absence of a defense zone under certain conditions, including situations where the structure density and location do not provide a reasonable opportunity for direct suppression on public land, but suppression on the private land would be enhanced by fire behavior modification on the adjacent public land.

Threat zone boundaries are determined at the project level following national, regional and forest policy. Threat zones generally extend approximately 1¼ miles out from the defense zone boundary; however, actual extents of threat zones are based on fire history, local fuel conditions, weather, topography, existing and proposed fuel treatments, and natural barriers to fire. Fuels treatments in these zones are designed to reduce wildfire spread and intensity. Strategic landscape features, such as roads, changes in fuels types, and topography may be used in delineating the physical boundary of the threat zone. (SNFPA ROD, pg. 40). Fire and fuels staff looked closely at the landscape, fire history, weather and proposed fuel treatments and determined that 1 ¼ miles beyond the defense zone would be appropriate to meet fire and fuels objectives for this project.

While both the defense and threat zones are primarily focused on treating hazardous fuels, additional treatments in the threat zones would carefully incorporate features that benefit other resources such as wildlife, forest health and insect and disease resilience. These features are listed in Table 4 as Leave Areas, Create Openings and Tree Enhancement. These features are described in detail in the Threat Zone Treatments Section below. In addition, the thinning treatment within the threat zone (variable density thinning) would emphasize varying tree density to create the horizontal heterogeneity that is inherent to these landscapes.

Management Direction for Threat Zones

Desired Conditions

- Flame lengths at the head of the fire are less than 4 feet
- Rate of spread at the head of the fire is reduced to at least 50 percent of pre-treatment levels
- Hazards to firefighters are reduced by managing snag levels in locations likely to be used for control of prescribed fire and fire suppression consistent with safe practices guidelines
- Production rates for fire line construction are doubled from pre-treatment level

Forest-wide standards and guidelines for fuels treatments include direction for reducing tree density to a level consistent with the site's ability to sustain forest health during drought conditions (SNFPA ROD, pg. 49).

Treatments

Vegetation and fuels management treatments are designed to remove ladder fuels, surface fuels and space residual trees and groups of trees in order to provide crown separation and also improve the health and vigor of the treated stands to accomplish desired conditions and consistency with Forest Plan. Threat zone treatments would be aimed at creating a heterogeneous forest structure that would be more resilient to wildfire. The vegetation and surface fuel management tools proposed to accomplish these treatments are displayed on a site-specific level in Table 4 above. The 'Implementation Tools' section below provides technical details about each tool. The vegetation treatments designed achieve desired conditions within the threat zone are described below.

Variable Density Thinning

This prescription is highly site-specific, and set within the context of the existing stand's structure and tree species composition. In general, variable thinning involves selective retention of individual codominant and subdominant trees and/or small groups of codominant and subdominant trees.
Trees up to 29.9" DBH could be removed according to a variable density prescription designed to increase forest heterogeneity, while also meeting fuels management objectives. On-the-ground decisions about which individual trees and groups of trees to retain are made in light of (1) ensuring overall stand structure remains intact following application of prescribed fire and (2) developing stand structures that trend towards reference conditions developed under active fire regimes and (3) achieving stand conditions that are consistent with the Forest Plan management direction for the threat zone allocation.

Variable density thinning objectives include: (a) increasing resilience of forest stands in order to improve the overall health and resiliency of the forest to fire, drought, insects and disease, (b) enhancing stand diversity (by retaining clumps of trees that can provide valuable wildlife habitat and creating subtle openings by thinning around these clumps), (c) reducing fuels, and (d) working towards stand level ecological heterogeneity. This prescription works off the existing forest characteristics, allowing for enhancement of natural variability such as small dense pockets of vegetation or small open areas. The variable thinning approach is based on the GTR 220 principle that varying stem density according to potential fire intensity effects on stand structure can create horizontal heterogeneity inherent to these landscapes. It is not based on spacing guidelines, but rather works within the context of the existing stand to emphasize retaining desired tree species compositions, basal areas, and desired stand structure elements (such as trees with some level of decadence or "defect"). The vegetation management and surface fuel management tools used to accomplish this treatment are displayed on a site-specific level in Table 4 above. The 'Implementation Tools' section below provides technical details about each tool.

Variable thinning would be applied using the following guidelines:

- Generally favor retention of pines over firs, especially in southerly facing areas and on ridges. Retained groups of larger trees (described under the bullet below) may include fir trees. Overall the emphasis for retained groups of trees is preserving or enhancing desirable stand structure rather than managing for any particular species composition.
- Retain groups of larger trees, generally comprised of five to ten (or more) trees of roughly similar size. Ideally, some of the retained trees should have desirable habitat features, such as forked or broken tops. Remove trees adjacent to these retained groups to improve the overall health and resiliency of the group to drought, insects and disease.
- Where a few (less than five) trees occur together, or where trees are scattered, retain the more vigorous trees by removing subdominant and, in some cases, co-dominant trees around them to reduce ladder fuels and competition for light, water, and nutrients.
- In areas of greater white fir dominance where large trees tend to grow in more of a clumped nature, emphasize retaining clumps or groups of generally five to ten trees and removing trees adjacent to these retained clumps to create small, variably shaped gaps.
- When making site-specific determinations on individual tree removal/retention preferences, vary the choices made so as to increase the variability at the micro-site scale.
- Variable thinning would not be applied in leave areas, create opening areas, adjacent to trails, powerlines or fuel break maintenance areas.

Leave Areas (LA)

LAs are small existing areas, ranging in size from 0.1-2.25 acres, within treatment units that provide continuous vertical and horizontal cover. Areas designated as LAs may contain multiple wildlife habitat elements such as: large down woody material, a mixture of tree age classes (including solitary and groups of large trees), large snags, multiple tree canopy layers, and/or trees with features associated with wildlife use (for example, platforms, mistletoe brooms, forked tops, and cavities). LAs would contribute to/enhance within-stand horizontal and vertical structural diversity and provide important old forest and/or mid-seral habitat elements. Designated LAs may represent multiple layered late-seral conditions with high levels of decadence and dead wood, or they may represent a mid-seral condition with brush and a medium sized tree overstory that provide important movement, hiding, and resting cover for wildlife. It is important to note that LAs would not be retained in the defense zone. No mechanical tree removal would be conducted in LAs.

Prescribed fire over the long term could be an important management tool within LAs, although only one entry would occur with this project. For LAs comprised of multiple sizes of trees, snags, and down wood, prescribed fire would be carefully applied to maintain key habitat elements, particularly snags and down wood. While underburning in LAs would likely result in some mortality of suppressed and subdominant trees, burning prescriptions would be designed and implemented to retain the overall structure of the LAs.

Create Openings (CO)

COs would be small areas, ranging in size from 0.1-1.25 acres, where all trees under 29.9" DBH would be removed. Typically these areas are comprised of existing clumps of dense, younger, and smaller diameter trees. Others COs are in areas as of sparse tree cover, thinner soils, or pockets of tree mortality. The removal of vegetation from COs would provide early-seral conditions, providing foraging habitat for old forest associated wildlife species, and enhance within-stand age and species diversity. Revegetation of the COs would add to the diversification of the BJE areas within the threat zone. Based on site conditions and on-the-ground evaluations, revegetation would occur 1) by planting a variety of tree species; 2) by planting a different genetic strain of tree species already on site; or 3) naturally by local shrub and tree seed sources, or a combination thereof. It is important to note that COs would not be created in the defense zone.

If an area exhibiting insect or disease mortality is identified in close proximity to a location planned for the create opening prescription, the interdisciplinary team may evaluate the potential to shift the CO prescription to the new area of mortality while maintaining the CO size and general location as well as the overall acreage of planned COs within the treatment unit. Implementation of the CO prescription would be flexible in order to respond to changed conditions, but could be shifted only after interdisciplinary team review and Responsible Official approval.

Prescribed fire over the long term could be an important management tool within COs, although only one entry would occur with this project. Within COs, prescribed fire would be applied to regenerate shrubs and create suitable areas for shade-intolerant tree species to regenerate.

Tree Enhancements (TE)

Tree enhancement thinning is different from variable density thinning in that tree enhancement thinning focuses specific attention on an individual isolated tree, whereas variable density thinning takes in account a larger stand-scale approach. An isolated tree is typically (but not always, as described below) a larger tree (greater than 24 inches) and defined by being located at least 20 feet away from the bole of any neighboring tree and no more than 50 feet from the bole of any neighboring tree (Churchill et al. 2013). Under tree enhancement thinning, the radial distance of treatment around isolated trees would be variable and based on site-specific conditions. Generally treatment distances would be 30 feet from the bole of the tree, with a minimum treatment distance of 20 feet and a maximum of 50 feet on steeper slopes. Larger distances are needed on the downhill side of isolated

trees in order to compensate for the longer flame lengths due to slope. Within the radial thinning distance of an isolated tree, all trees less than 24" DBH would be removed. Removal of these trees would result in increased root and diameter growth while also improving overall health and resiliency of a targeted tree. In addition, the removal of understory trees removes ladder fuels which minimizes the risk that fire could carry into the canopy of the isolated tree.

The goal of tree enhancement thinning treatment is to manage for and protect specific individual isolated trees with the intent that these individual trees will become the well-established, open grown and resilient trees of the future. Overall, these carefully selected trees tend to be larger, typically greater than 24" DBH, and at least a generation older than trees in the surrounding area. However, other trees have been identified for tree enhancement thinning due to their potential to become well established, resilient trees in the future. Many of these trees have become overgrown and crowded by younger, shade tolerant trees. Treatment is designed to increase the resiliency of the selected trees by isolating them from the effects of fire, drought, insects, and disease while also maximizing the potential for diameter and height growth by removing adjacent competing trees.

Isolated trees tend to be the most resilient trees on the landscape, thus, they have the most potential to become large and will usually do so in the shortest amount of time. When these trees do die, they become the largest dead wood components on the landscape and remain on the landscape as structure for the longest period of time adding to the diversity of habitat on the landscape. The ratio of isolated trees to clumps of trees, LAs, and COs would fluctuate by topographic position on the landscape. In a study of frequent-fire pine and mixed conifer forests in western North America, isolated trees accounted for 32% of the total trees with 51% of the basal area in reference plots that experienced active fire (Churchill et al. 2013). Isolated trees could possibly compose as much as 30% of the stand's trees.

Descriptions of Desired Stand Conditions within the Threat Zone

After treatment, the stands of the Threat Zone are to be vigorous and structurally diverse. Stocking levels are anticipated to be 80 to 100 ft^2 per acre in terms of basal area on average. However, pockets of significantly more dense area, up to 2.25 acres, and openings, up to 1.25 acres, will exist. Stand structure is uneven-aged with trees of all ages present. Suppressed and intermediate trees are minimal and are, generally, only found in established Leave Areas. The stand canopies are open to moderate, in terms of canopy closure, allowing for growing space for regeneration of shade intolerant species. Horizontal structure is generally in groups. Groups generally consist of 5 to 10 trees of a similar size. Approximately 70% of the stocking is found growing in groups. Stocking is dominated by fire tolerant species, such as sugar pine and Jeffrey pine (greater than 75% of the basal area), although species of less fire tolerance; such as white fir, lodgepole pine, and red fir; are present (less than 25% of the basal area). Competition among trees is low, allowing for the adaptive capacity of stands in face of drought and climate change. Individual trees and stands are generally healthy and vigorous, increasing resiliency and defensive capabilities to attacks for forest pests, such as bark beetles.

Implementation Tools

The following vegetation and fuels management tools would be used for treatment implementation throughout the project area. Table 4 displays the tools proposed to be used for each unit.

Mechanical Removal

In this document the term "mechanical removal" is used to describe the tools in which selected conifer trees ranging in size from 10.0" to 29.9" DBH would be removed from the forest. For the Big Jack East project there are two methods of mechanical removal being proposed: traditional mechanical harvest and cut-to-length harvest. Following the initial mechanical removal, treated areas would have a follow-up surface fuels treatment that would

continue to move the harvested areas towards the desired conditions for the respective defense and threat zones.

- **Traditional mechanical harvest,** also known as "whole tree yarding", is a ground based operation that cuts the trees designated for removal using a tracked mechanized piece of equipment called a feller buncher. The trees, placed in bundles by the feller buncher, are transported by skidders to the roadside landing with tops and limbs still attached. Skidders, either rubber tired or tracked, work on a network of approved skid trails that fan out from the designated landing. Once the trees are at the landing, they are delimbed, topped, and processed into sawlogs for removal by log truck. After the initial mechanical harvest and sawlog removal, remaining biomass material on the landings would be treated by the Landing Pile Burn or Remove Tool (described below). Also, after traditional mechanical harvest, remaining surface fuels within each harvest unit would be assessed. If necessary to meet the desired conditions of the defense and threat zones, an additional surface fuels treatment, such as mastication, possibly followed by jackpot or underburning, or grapple pile followed by pile burning, would be applied. See description of surface fuels treatments below.
- **Cut-to-length** is a ground based operation that cuts trees designated for removal using a rubber tired mechanized piece of equipment called a processor. The processor completes the felling, delimbing, and bucking at the stump area, leaving limbs and tops in the forest. The processor decks the logs throughout the harvest area on a network of approved forwarder trails. Following the decking and processing of logs in the forest, a second piece of rubber tired equipment called a forwarder gathers the processed logs and transports them to the roadside for removal by log truck. After cut-to-length harvest, remaining surface fuels within each harvest unit would be assessed. If necessary to meet the desired conditions of the defense and threat zones, additional surface fuels treatment, such as mastication, possibly followed by jackpot or underburning, or grapple pile followed by pile burning, would be applied. Chip and remove would also be an option, but currently options for removal are limited. Generally after sawlog removal with cut-to-length operations there are no significant amounts of biomass requiring treatment remaining on the landings. See description of surface fuels treatments below.

With both mechanical treatments there is an inherent hand treatment component. For example, hand falling with a chainsaw may be required for trees exceeding the capabilities of the feller buncher or processer. Generally these pieces of equipment are capable of falling trees up to 22 inches at the stump. Hand falling may also be required for resource protection in other areas such as stream buffer zones or other sensitive areas.

Temporary roads and infrastructure needed to access mechanical removal units and remove material are detailed in the Road Actions and Product Removal/Treatment Infrastructure section below.

Mastication

Mastication is the rearranging of woody biomass material, such as trees smaller than 11" DBH, brush, and downed woody material on site. It is a ground based operation that uses a tracked or wheeled mechanized piece of equipment called a masticator to "chew" up the biomass on site. Mastication does not actually remove fuels from the treated area, but changes the size, continuity, and arrangement of the fuels, leading to an acceleration of decomposition rates of processed material and producing a desired change in fire behavior by reducing the amount of oxygen within the fuel structure. For example, a standing tree, or vertical fuel, is chewed up or rearranged into many smaller pieces of horizontal fuel. Mastication may be a follow-up treatment to mechanical removal, or it may be the initial tool used in an area. After mastication operations, remaining surface fuels within each harvest unit would be assessed. If necessary to meet the desired conditions of the defense and threat zones an additional surface fuels treatment, such as jackpot burning or underburning, would be applied.

Grapple Pile

Grapple piling is a ground based operation that uses a tracked or wheeled mechanized piece of equipment to lift and/or gather woody biomass material into piles for burning at a later date. One method of grapple piling uses the machinery to "lift" the living vegetation (small trees and shrubs) out of the ground and then gathers the material into grapple piles. Lifting the vegetation out of the ground slows vegetation sprouting. Grapple piles may also include existing dead and downed woody surface fuels. Another manner of grapple piling is completed by hand cutting of vegetation (small trees and shrubs) with chainsaws and then using a tracked or wheeled mechanized piece of equipment to gather this cut material into grapple piles. Small trees (no larger than 11" DBH) would be treated with grapple piling. Grapple piling may be a follow-up treatment to mechanical removal, or it may be the initial tool used in an area. Piles created by grapple piling would predominantly be burned as described in the Pile Burn (Grapple or Hand) section below. There is a limited chance that material from grapple piles would be removed (as described in the Landing Pile Burn or Removal section below) versus burned in piles, and removal would remain an option throughout implementation.

Piling fuels can be an effective treatment for reducing and removing the amount of surface fuels, breaking up the horizontal continuity of surface fuels across a landscape and increasing the separation between surface and canopy fuels. Burning the piles to remove and reduce the amount of fuels in a stand or across a landscape makes the reintroduction of low-intensity fire by underburning more feasible. There are increased prescribed burning opportunities for the burning of piled material because there is a larger timeframe or burn window available.

Hand Thin

Hand thinning is a method used to remove conifers less than 11" DBH in places where access with mechanical removal equipment is not possible or appropriate. Trees are felled and cut into smaller lengths by individuals using chainsaws. Mostly, the cut trees would be hand piled for burning at a later date when material has cured and would burn more effectively and with less smoke generated. In some areas, where accessible and within 100-200 feet from a road, the small tree bole material could be left in place or moved to the roadside for utilization by the public for fuelwood. Limbs in these areas would be piled for burning. There are also hand thin areas where hand piling would not be conducted for resource protection. In these areas, cut material would be transported out of the protected area in a manner that would not disturb the ground cover, then piled or removed. Options for chipping and/or removal of hand thinned material are limited, but would be considered during implementation if the opportunity arises.

Chipping

Chipping is a mechanical operation that takes biomass material and "chews" it into smaller pieces. Chipping may occur at landings, along roadsides or within units. Chipping within a unit has several limitations such as accessibility, material size and desired residual fuel loading. Chips created within a unit may be removed or distributed back into the unit to a depth no greater than 4 inches. Material chipped on a landing is generally removed, but chips may also be distributed on and adjacent to the landing to a depth no greater than 4 inches. Chipping and removal options are very limited at this time. Opportunities for chipping and distributing chips throughout the unit are also limited, but both of these options would be considered during implementation whenever feasible.

Pile Burn (Grapple or Hand)

Residual activity fuels and some naturally occurring fuels would be piled into burn piles by hand or machine, as described above. Pile burning within treatment units is designed to remove surface fuels generated from treatments and existing fuels on the ground. Pile location and size is dictated by existing conditions; however, piles would be preferentially placed outside of sensitive areas such as riparian conservation areas and cultural resource sites. In areas denoted with piling restrictions due to resource protection needs, material would be

transported outside of the denoted area in a manner that does not disturb the ground cover, and piled and burned. Piles are typically burned under fall-like conditions, in winter months, or during periods of low fire danger. These conditions help to minimize the amount of mortality of remaining vegetation. There are increased prescribed burning opportunities for the burning of piled material because there is a larger timeframe or "burn window" available. Pile burning can take place in the snow where underburning cannot.

Underburn

The entire project area would be analyzed for underburning; however, it is likely that only a portion of the project would receive this treatment. Underburning is usually the last treatment in a series of treatments, or it can be used as a stand-alone treatment or a maintenance treatment. After initial vegetation treatment is completed it may be determined that a unit will not need an underburn treatment. However, there may be other areas that would need a maintenance treatment which means that an area may be burned more than once over the course of many years. Underburning actions would adhere to the resource protection measures detailed in Appendix B. Not restricting underburning to vegetation treatment unit boundaries would allow for the use of logical and natural control lines for implementation.

An underburn is a prescribed fire ignited under the forest canopy that focuses on the consumption of surface fuels, but not the overstory vegetation. Underburns are ignited using small strips of fire to burn with low to moderate intensity to mimic a wildfire under controlled conditions in order to reduce downed woody debris, needles and duff, while removing small areas of shrubs and occasional pockets of trees. Widening or narrowing the width between strips increases or decreases fire intensity. Underburning requires the use of firelines to contain the prescribed fire within the targeted areas. Firelines are linear features that are cleared of vegetation and fuels down to mineral soil. Firelines are typically two to three feet wide when constructed by hand, however they can be up to four feet wide when created by small machinery. Existing natural openings, roads or trails are effective firelines and are used whenever possible in lieu of handline construction. The determination of size of underburn units is based on areas that can be easily managed with available resources. Another consideration for the size of an underburn unit is smoke dispersion forecasts. An underburn is the most practical way to reduce accumulations of surface fuels in this project area. However, it is also the most difficult due to the small window of opportunity due to the short burn window for these types of operations. Underburning has been difficult to accomplish in the past.

Jackpot Burn

Jackpot burning is a modified underburn that addresses high concentrations of naturally-occurring or thinning-related downed woody debris that is not piled. Different than underburning because in lieu of strip ignition, jackpot burning involves igniting concentrations, or "jackpots", of vegetative fuels on the forest floor. The result of jackpot burning is a mosaic pattern of vegetative fuel consumption. This technique works well when surface fuels loading is very high following vegetation treatments.

Landing Pile Burn or Removal

After traditional mechanical removal, biomass material (limbs, tops, and defect material) remains on the landing from operations. This material would be decked or piled for burning. Landing piles are generally larger than grapple piles and may burn for longer periods of time. There is the possibility of multiple landing piles on each landing. To facilitate faster burning, efforts would be made to create more, smaller landing piles on the landings versus one large landing pile. With cut-to-length operations, generally there is no significant biomass material left on the landings that requires burning or removal. If the rare occasion did occur, the small amount of material would be piled for burning or removed.

The preferred treatment of the biomass material remaining on the landings would be to remove as firewood, chips or other biomass product, but removal is greatly dependent on the commercial biomass market at the time

of implementation. Currently options for removal are limited, but options will be monitored throughout the implementation of the project and when feasible removal will be implemented.

Borax

Apply a borate compound (trade name Sporax® or Cellu-Treat®) by hand to cut stumps of all conifer species ≥ 14 inches stump diameter to reduce the spread of Annosus root disease caused by the fungus *Heterobasidion annosum*. Applications of the borate compound would follow all State and Federal rules and regulations as they apply to pesticides.

- The borate compound would not be applied within 25 feet distance of surface water, or a greater distance if determined necessary upon the finalization of the U.S. Fish and Wildlife Service Biological Opinion for Sierra Nevada Yellow-legged Frog (Biological Opinion).
- Where permissible under the final Biological Opinion, the borate compound would be applied to all conifer stumps within 4 hours of felling, at a rate of approximately 1 pound/acre on average, though up to 2 pounds/acre could occur.
- The borate compound would not be applied during periods of sustained rain.

Prescription Metrics

Metrics for post-treatment structural and compositional elements developed to guide silvicultural and fuels prescriptions include basal area (BA) and canopy cover (CC). The site-specifically defined values for the metrics for each treatment unit are grounded in the scientific literature as well as Forest Plan direction.

The following averages were weighted by unit acreage. Actual unit by unit values can be found in Appendix A. Values were derived from common stand exams (CSE) sample plots conducted by the Truckee Ranger District in May and June of 2017. These data were processed and utilized for modeling in the Forest Vegetation Simulator (FVS).

Basal Area

Basal area is a mathematically derived value for the density of an area of forest. Basal area is expressed as square feet per acre (ft² per acre). It is the amount of surface area occupied by trees stems or boles at 4.5 feet in height per acre. This metric is used to indicate the amount of stocking by species and by size class for the project area.

The formula for basal area is: BA=TPA x (QMD x .005454)^2, where TPA is trees per acre and QMD is quadratic mean diameter.

Basal areas within the Big Jack East Project Area range from 47 ft² per acre to 221 ft² per acre with an average of 150 ft² per acre. The following table indicates the percent distribution by species and tree size class. Table 6 below details the current conditions as well as approximate desired conditions for the Big Jack East Project Area.

Table 3. Current Stocking Conditions

Species	Current % of Basal Area	Desired % of Basal Area	Size Class (DBH)	Current % of Basal Area	Desired % of Basal Area
Jeffrey pine	61%	74%	**0-9.9”**	7%	1%
Sugar pine	<1%	1%	**10-19.9”**	36%	22%
Lodgepole pine	6%	4%	**20-29.9”**	33%	32%
White fir	32%	20%	**≥30”**	24%	45%
Red fir	<1%	1%			

The silvicultural goal related to basal area would be to maintain stocking in all conifer tree species as well as all size classes. This would be necessary in order to maintain species and structural diversity (climate change strategy).

Canopy Cover

Canopy cover is the defined as the percentage of the forest floor that is topped by tree canopy. Canopy cover is expressed as a stand or unit level average as derived from LiDAR measurements Current canopy cover at the treatment unit scale ranges from 19% to 60%.

Desired canopy cover conditions are variable and site specific. However, averages are expected to be between 30%-35% for the whole of the Project area. Dense pockets of vegetation, such as Leave Areas, would be significantly more densely covered (>60% CC), while open areas would have lower canopy cover levels (estimated 15% CC).

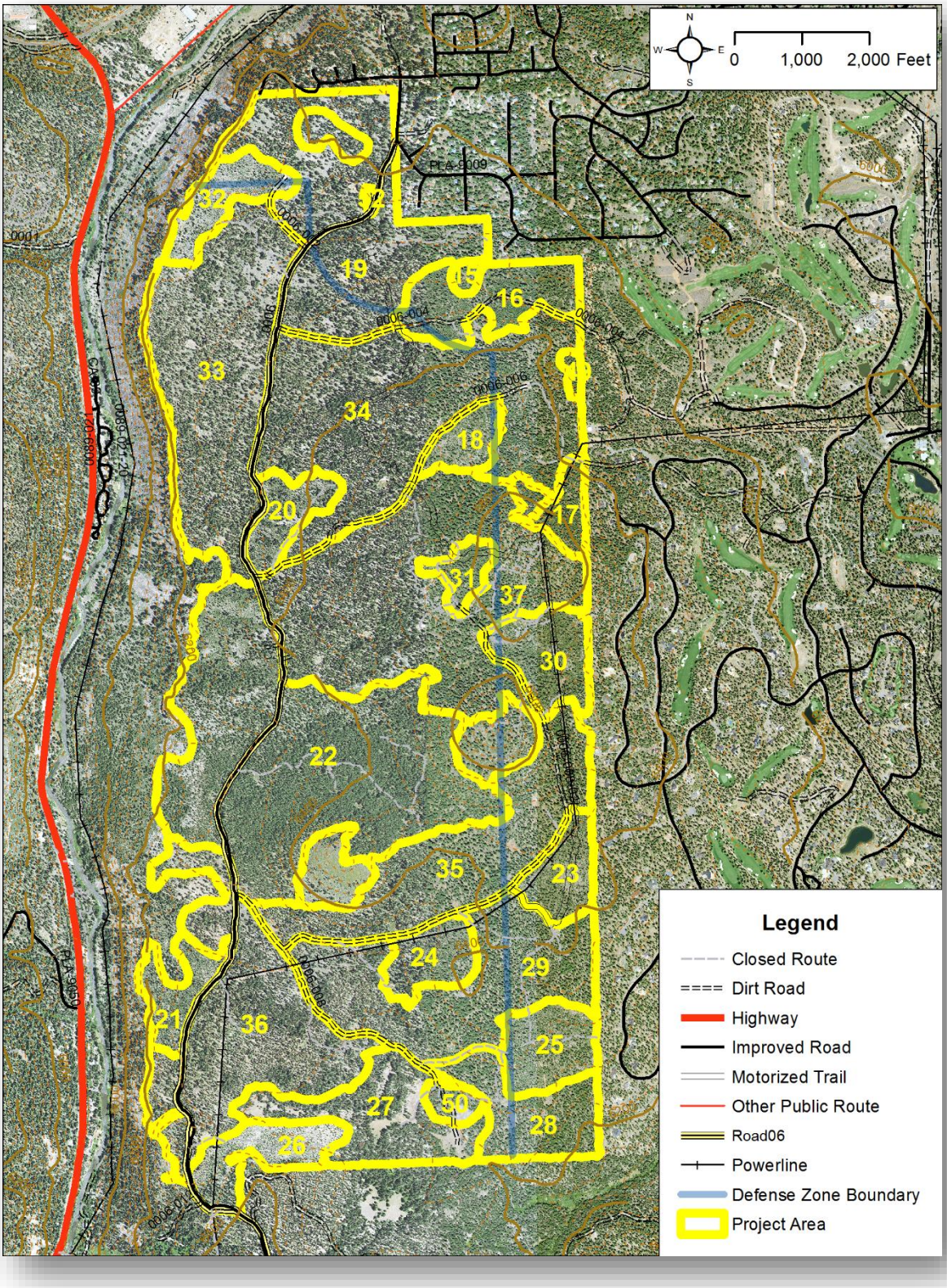

Figure 4. Aerial Imagery of Project Area

Alternative 2: No Action

Under the No Action Alternative (Alternative 2), none of the activities proposed under Alternative 1, the Proposed Action, would be implemented. The No Action Alternative would not preclude activities that have already been approved in this area or those being planned as separate projects.

ENVIRONMENTAL CONSEQUENCES

Indicators Used to Analyze Impacts on Forest Stands

The following indicators are used to assess the impacts of the proposed action and other alternatives on forest stand conditions in the Big Jack East Project Area: stand density and structural diversity (both vertical and horizontal diversity). The sections below discuss each of these indicators in detail.

Stand Density

Various methods exist for the measurement of stand density. Among these area basal area, stand density index, volume, and canopy cover. Stand density index (SDI) can be used to assess competition for resources, availability of individual tree and stand growth, risk of mortality, and forage production. However, SDI is not as easily recognizable in the field, nor is it used in Sierra Nevada Forest Plan Amendment standards and guidelines. Therefore, basal area is used to evaluate density in the Project area. A target basal area of about 80-100 ft^2 will be used when marking trees in the field to achieve the desired species composition, diameter distribution and stand density for the Big Jack East Project treatment units.

Structural Diversity

Structure, both vertical and horizontal, is assessed between the action and no action alternative. Basal area by size class is used to compare vertical structure among alternatives. Canopy cover is used to compare horizontal structure between the alternatives.

Methodology and Assumptions

Stand exam data were collected using Common Stand Exam (CSE) protocol by Tahoe National Forest personnel in May and June of 2017. These data were utilized for the Forest Vegetation Simulator (FVS) to model and project forest stand characteristics over a 50-year horizon within the Big Jack Project Area. The data collected and the model results indicate projected ecological and vegetative trends under each alternative (Alternative 1 – Proposed Action and Alternative 2 - No Action).

The modeled results from FVS are not intended to be absolute values, but rather they display relative trends in stand development for each treatment unit. It is important to note that, while the model is an abstraction of reality and does not provide an exact representation of on-the-ground conditions, it is a useful tool for making comparisons between the alternatives.

Application of Forest Vegetation Simulator

The collected CSE data was organized by treatment units prior to being loaded into FVS to be processed and modeled. Additionally, data were collected the same year as processed and, therefore did not require to be extrapolated to produce a modeled current condition for the Project area.

The Western Sierra Variant (Chad Keyser 2008) of the Forest Vegetation Simulator (FVS) (Dixon 2003) was used to model conditions at 10-year intervals for 50 years after application of the silviculture and fuels prescriptions proposed under Alternative 1 and if no actions were taken (Alternative 2).

FVS was run for three separate scenarios: No Action Alternative, Action Alternative: Threat Zone, and Action Alternative: Defense Zone. The Action Alternative was split into two portions because some of the treatment units are located within both the defense and threat zones. These two zones were then weighted by acres and merged in order to produce one set of values for each unit. Values for each of the Defense and Threat Zone portions of the units can be found in Appendix A.

Leave Area (LA) and Create Opening (CO) acres were not used in calculating treatment effects on stand density (as measured by basal area and SDI) or canopy cover because these treatments, which are designed to introduce variability into the treated stands, occupy such small scales, the FVS model does not provide a means for quantifying their effects on a per acre basis across a treatment unit. Further, LA and CO treatments are prescribed in similar amounts across most treatment units, so either treatment effect, averaged across the unit, would likely be neutralized by the other.

Forest stand structure metrics derived from LiDAR data are available for the Big Jack East Project area. LiDAR data are especially useful for providing accurate estimates of existing canopy cover levels. In general, FVS canopy cover estimates are consistently higher and more variable compared to field observations and LiDAR canopy cover estimates for the Big Jack East Project area. LiDAR-derived canopy cover estimates were therefore used to characterize existing canopy cover levels in the treatment units, with FVS modeling results applied to these initial estimates to characterize the changes in canopy cover levels following treatments and over the 50-year projection timeframe. The analysis assumes that hand thinning and mastication treatments (which would remove only small trees up to 11 inches dbh) would not reduce existing canopy cover (the ground area covered by tree crowns). Regeneration was added through the model into the treatment units over the 50-year modeling time frame. Regeneration, 25 seedlings per acre on average, was added once every 10 years throughout the modeling period.

Comparison of Alternatives

The modeled results are compared in the following section. This comparison is intended to demonstrate the potential effects of the alternatives within the Project area through the next 50 years. Appendix A presents a unit-by-unit comparison of the effects of the alternatives on stand density, canopy cover, and diameter distribution.

Stand Density

Stand density can be examined in several ways. The two examined as part of this Report are basal area and canopy cover.

Current conditions indicate that, overall, stands in the Project area are at full occupancy. Individual tree growth is declining as trees actively compete for resources (sunlight, water, and nutrients). In 50 years, without active management, it is anticipated that the stands in the Project area would be experiencing tree mortality or would be approaching a state of competition-induced tree mortality. Meaning, simply, that tree mortality would be common due to lack of finite resources. This does not take into account drought conditions which would likely result in tree mortality at much lower stocking levels.

Projections indicate that the proposed action would create a significant amount of growing space and make resource competition less of a limiting factor for tree viability. Under the proposed action (Alternative 1), tree vigor would improve and the treated stands would be less susceptible and more resilient to insects and diseases, such are bark beetle and root rot. Over time, without additional future management actions, such as prescribed fire or pre-commercial thinning, stocking/competition levels are anticipated to return to current levels (full site occupancy).

While stand density index and percentage of maximum stand density index is a quality metric for evaluating stocking and competition, it is not easily measured in the field or utilized in effects analyses conducted for other resources. Basal area, however, adequately fills in for these shortcomings.

Given the current diameter distributions and target stocking of roughly 75% Jeffrey pine and sugar pine and 25% white fire and other species, a reduction of basal area to about 80-100 ft^2 would reduce stand densities to desired levels. Mechanical treatments would thin to this level and would fall within the parameters established by the *Sierra Nevada Forest Plan Amendment Record of Decision* (SNFPA ROD 2004) standards and guidelines for mechanical thinning treatments in mature forest habitat (CWHR types 4M, 4D, 5M, 5D, and 6) in the WUI defense zone and in the eastside pine type (SNFPA ROD Standards and Guidelines # 6 and #8, pp. 50 and 51). Figure 8 below displays average basal area across the Big Jack East Project area for each alternative, post-treatment (Year 1) and projected out 50 years (Year 50).

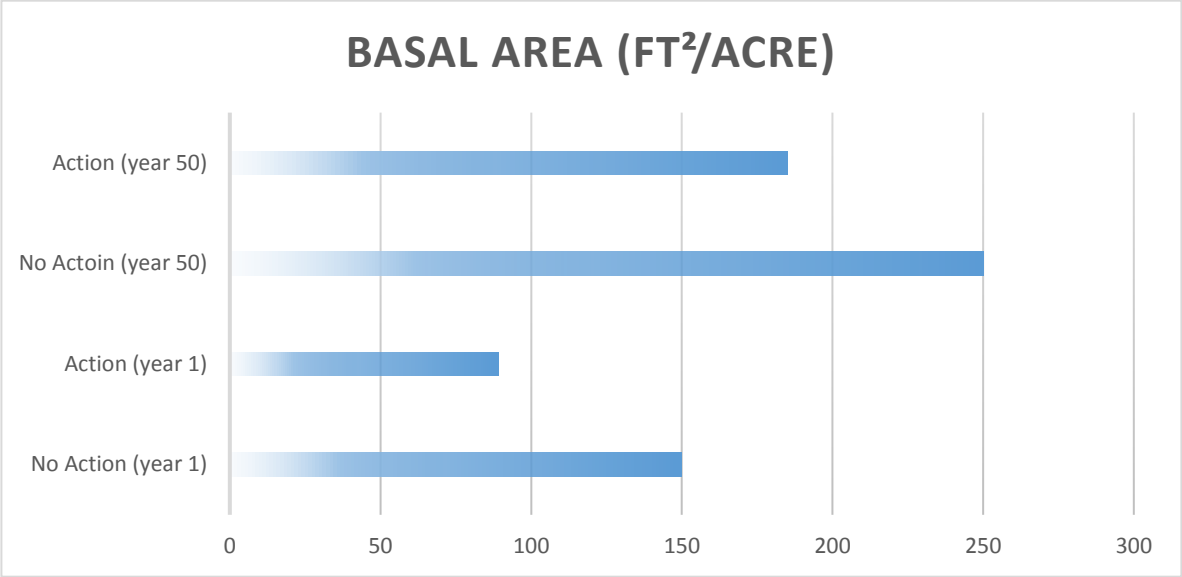

Figure 5. Average Basal Area

Structural Diversity

The metrics utilized to compare vertical and horizontal stand structure are: basal area by size class and canopy cover.

Vertical structure can be viewed in terms of stocking of all tree sizes within the Project area. In order to maintain diversity of tree size/age classes within the Project area while reducing fuel ladders, uneven-aged structure must be taken in the context of groups instead of a multiple layered group. That is, groups of multiple ages of trees are maintained across the stand or landscape as opposed to a contiguous multiple layered stand or landscape. The Proposed Action's (Alternative 1) application of variable density thinning reduces stocking across all tree diameters, below the diameter limit, within the Threat Zone in order to create zones stocked with smaller trees along with Leave Areas in order to establish areas of multiple aged structure. Areas within the Defense Zone would, generally, provide less vertical structure, given the thin from below approach that is prevalent within the mechanically thinned units in this Zone. However, the mastication and hand thinning units would retain stocking to much lower diameter limits (trees greater than 11" DBH).

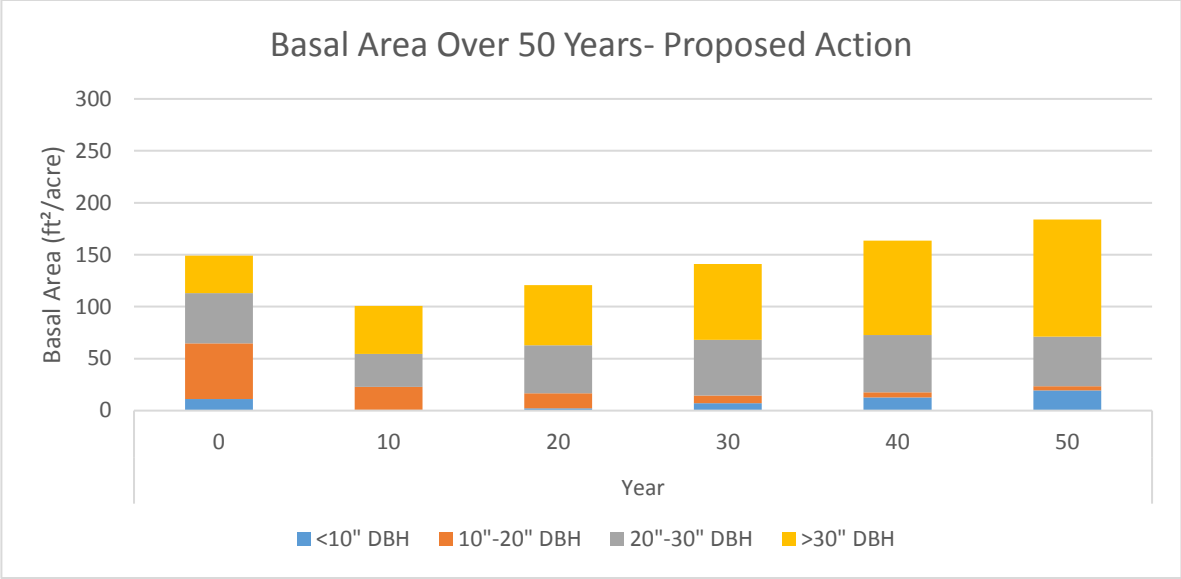

Figure 6. Basal Area by Size Class, Proposed Action

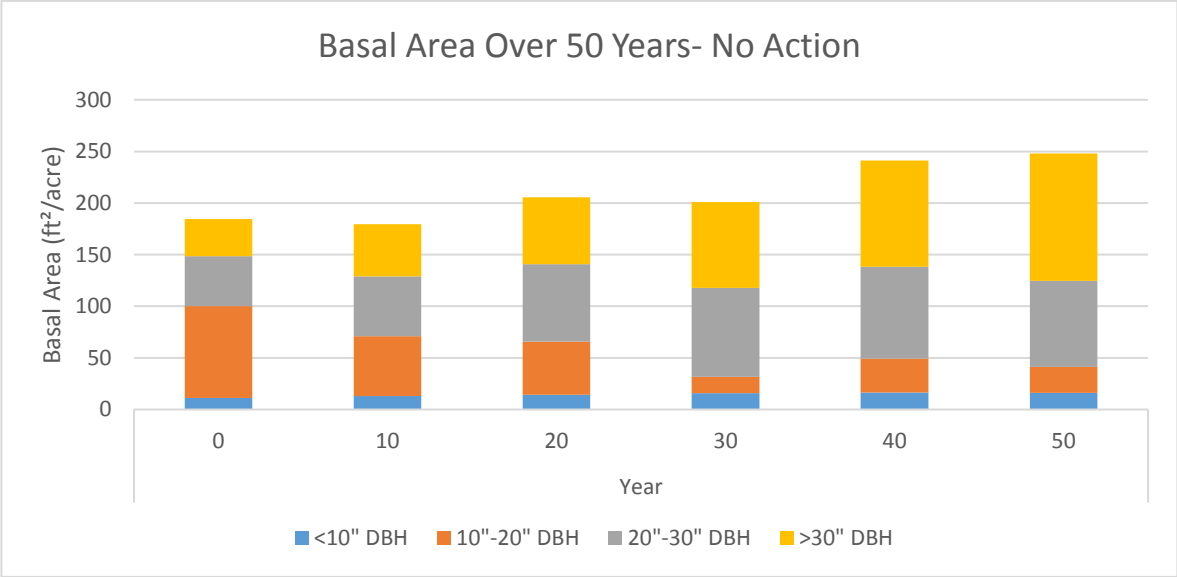

Figure 7. Basal Area by Size Class, No Action

Canopy cover is utilized as a measure for quantifying the horizontal structure within the treatment units, and, to a larger extent, the Project area. Current conditions within the Project area are variable. Existing canopy cover at the treatment unit scale ranges from 19% to 60%. Over 50 years without treatment, it is anticipated that the more open areas within the Project area would fill with crowns of adjacent groups as well as regeneration. Appendix A displays current and projected canopy cover levels for each treatment unit.

Given the variable density thinning proposed through the majority of the Project area, trees would be retained, generally, in groups or clumps. These openings between groups would provide areas for shade intolerant seedling development as well as reduce the risk of active crown fire spreading through and between stands. Within 50

years of treatment, it is expected that many of the gaps and openings created would be filled in with regeneration and that groups of initially smaller tree sizes would increase in terms of tree size composition.

Summary of Comparison of Alternatives

The following table summarizes the efficacy of the Proposed Action Alternative to meeting the silvicultural goals and objectives of the Big Jack East Project.

GOALS AND OBJECTIVE	PROPOSED ALTERNATIVE	NO ACTION ALTERNATIVE	COMMENTS
GOAL #1: REDUCTION OF FIRE RISK	✓		Proposed action effectively meets the objectives related to Fire Risk.
OBJECTIVE A: REDUCTION FUEL LOADINGS	✓		Proposed action reduces vertical and horizontal fuel layer.
OBJECTIVE B: IMPROVEMENT OF EFFECTIVENESS OF FIRE SUPPRESSION	✓		Proposed action re-establishes the Sawtooth Road fuel beak, reduces the risk of active crown fire, and establishes the Defense Zone within a ¼ mile of boundary with private property.
OBJECTIVE C: CREATE DEFENSIBLE SPACE NEAR COMMUNITIES	✓		Proposed action establishes the Defense Zone within ¼ mile of private property boundary and the Threat Zone within 1.25 miles within the Defense Zone.
GOAL #2: IMPROVEMENT OF RESILIENCY AND RESISTANCE	✓		Propose Action effectively meets the objectives related to the resilience to insects, disease, fire, drought, and climate change.
OBJECTIVE A: INSECT AND DISEASE	✓		Overall vigor and health of stands within Big Jack Project area is improved. Stands are more resilient to the effects of agents such as bark beetles and root disease.
OBJECTIVE B: FIRE	✓		Proposed action restores dominance of fire tolerant species and large individuals within the project area.
OBJECTIVE C: DROUGHT AND CLIMATE CHANGE	✓		Competition for resources, such as water and nutrients, is reduced among residual stocking. Fire adapted forest system is restored. Vigor is improved among residual trees, improving resilience to insects and disease. Diverse set of age classes is maintained and large “legacy” trees are maintained.

NFMA FINDINGS

All treatments proposed under the Big Jack East Project have been designed to be consistent with Forest Plan direction, as amended, including *Sierra Nevada Forest Plan Amendment Record of Decision* (SNFPA ROD 2004) standards and guidelines for mechanical thinning treatments in mature forest habitat (CWHR types 4M, 4D, 5M,

5D, and 6) in the WUI defense zone and the eastside pine forest type (SNFPA ROD, Standards and Guidelines #6 and #8, pp. 50 and 51).

The minimum specific management requirements to be met in carrying out projects and activities for the National Forest System (NFS) are set forth in this section. Under 16 U.S.C. 1604 (g)(3)(E), a Responsible Official may authorize project and activity decisions on NFS lands to harvest timber only where:

1. *Soil, slope, or other watershed conditions will not be irreversibly damaged;*

Implementation of the proposed action would adhere to Best Management Practices for Protecting Water Quality (BMPs) and Forest Plan standards and guidelines (including Riparian Conservation Area, RCA, guidelines) for protecting soil and water resources. Best Management Practices and Riparian Conservation Area Guidelines for the Big Jack East Project are included the Big Jack East Project Record.

2. *There is assurance that such lands can be adequately restocked within five years after harvest;*

The areas treated in the Big Jack East Project would remain adequately stocked following thinning and follow-up fuels treatments. Subsequent stocking surveys would be performed within the project area the first and third year after implementation. If any areas larger than a quarter of an acre were considered insufficiently stocked as outlined by the Forest Plan by the third year stocking survey, reforestation efforts would commence.

3. *Protection is provided for streams, stream banks, shorelines, lakes, wetlands, and other bodies of water from detrimental changes in water temperatures, blockages of water courses, and deposits of sediment, where harvests are likely to seriously and adversely affect water conditions or fish habitat; and*

Management requirements incorporated into the proposed action are designed to reduce the risk of accelerated erosion and sedimentation due to silviculture and fuels treatment activities. The proposed action's Best Management Practices for Protecting Water Quality (BMPs) and the Forest Plan standards and guidelines (including RCA guidelines) for protecting soil and water resources are the primary measures for preventing and mitigating impacts from nonpoint source water pollution, such as fine sediment and changes in water temperature. Consistent with Forest Plan direction, a riparian conservation objective (RCO) analysis has been completed for the proposed action (available in the project record), which demonstrates that proposed activities would not seriously or adversely affect water quality or riparian/aquatic conditions.

4. *The harvesting system to be used is not selected primarily because it will give the greatest dollar return or the greatest unit output of timber.*

Treatment method selection was based on resource protection rather than economics. Steeper slopes (those generally over 25 percent) are not proposed for mechanical harvest, but for hand work only.

A Responsible Official may authorize project and activity decisions on NFS lands using clearcutting, seed tree cutting, shelterwood cutting, and other cuts designed to regenerate an even-aged stand of timber as a cutting method. None of the treatments proposed for the Big Jack East Project are designed to regenerate even-aged stands of timber.

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APPENDIX A

Current Conditions

Unit	Acres	Basal Area					LiDAR Canopy Cover %	Trees per Acre					QMD	SDI
		Total	≥30" DBH	20"-29.9" DBH	10"-19" DBH	<10" DBH		Total	≥30" DBH	20"-29.9" DBH	10"-19" DBH	<10" DBH		
15	4.4	183	78	50	48	8	42	213	12	15	43	143	19.3	286
16	52	221	15	155	35	16	34	155	2	35	51	66	17.6	323
17	16.4	100	0	0	80	20	51	158	0	0	84	75	10.8	215
18	19.5	80	0	0	80	0	28	79	0	0	79	0	13.7	184
19	165.2	183	78	50	48	8	35	213	12	15	43	143	19.3	286
20	27.2	90	20	10	50	10	30	79	3	2	55	20	14.4	198
21	27.1	107	0	0	100	7	31	127	0	0	93	34	12.4	204
22	300.7	136	4	30	87	15	42	190	1	12	77	101	13.9	261
23	28.5	90	0	10	70	10	28	121	0	4	66	51	11.7	161
24	28.5	60	10	20	30	0	29	45	2	8	35	0	15.6	94
25	37.2	107	0	0	100	7	27	127	0	0	93	34	12.4	204
26	36.9	62	0	10	45	7	19	142	0	4	52	86	12.8	129
27	62	179	36	48	88	7	51	164	6	17	73	69	17.6	282
28	53.2	162	24	112	24	2	37	168	4	38	26	100	20.7	244
29	137.9	168	43	47	67	12	35	140	7	16	54	64	16.3	256
30	40.3	47	0	15	15	17	30	84	0	6	13	65	11.8	101
31	14.1	140	0	40	80	20	29	153	0	15	87	51	12.9	249
32	30.9	62	0	10	45	7	21	142	0	4	52	86	12.8	129
33	180.4	189	48	51	59	27	34	333	8	17	51	257	13.5	379
34	236.5	148	48	62	37	2	39	88	8	18	30	32	20.5	224
35	130.6	139	56	45	28	10	33	148	9	14	21	104	21.1	198
36	164.7	164	49	68	39	6	36	239	8	22	35	174	20.5	246
37	239.7	166	53	61	38	14	39	179	9	19	36	115	15	267
49	3.5	148	48	62	37	2	60	88	8	18	30	32	20.5	224
50	20.6	110	15	30	40	25	33	115	2	9	47	57	13.3	204
52	1.1	183	78	50	48	8	46	213	12	15	43	143	19.3	286

50 YEAR PROJECTIONS: NO ACTION ALTERATIVE

Unit	YEAR	BA	BA>30"	BA20-30"	BA10-20"	BA<10"	Canopy Cover %	TPA	TPA>30"	TPA20-30"	TPA10-20"	TPA<10"	QMD
15	2017	183	78	50	48	8	42	213	12	15	43	143	19.3
15	2027	208	92	56	46	12	45	221	13	16	36	156	21
15	2037	227	113	58	39	16	47	224	15	18	28	163	22.6
15	2047	244	136	52	34	20	49	227	18	17	22	170	19.9
15	2057	258	150	57	29	23	50	227	19	18	19	171	17.8
15	2067	259	158	56	23	22	49	209	19	17	19	153	18.9
16	2017	221	15	155	35	16	34	155	2	35	51	66	17.6
16	2027	250	182	10	43	8	36	158	34	3	49	61	20
16	2037	256	193	10	48	6	37	146	32	3	47	64	22.6
16	2047	254	196	11	43	4	36	137	30	3	36	67	25
16	2057	254	200	14	37	3	36	133	28	5	29	71	26.2
16	2067	255	202	16	31	4	36	133	26	5	21	80	28.1
17	2017	100	0	0	80	20	51	158	0	0	84	75	10.8
17	2027	145	0	17	99	30	61	174	0	8	75	92	13.2
17	2037	195	0	88	97	7	69	190	0	33	102	53	15.4
17	2047	227	0	136	89	2	74	187	0	44	91	53	17.5
17	2057	255	18	144	91	2	77	184	3	41	78	62	19.5
17	2067	263	67	110	84	2	77	160	12	29	60	60	21.6
18	2017	80	0	0	80	0	28	79	0	0	79	0	13.7
18	2027	111	0	8	103	0	33	94	0	3	73	18	16.3
18	2037	143	0	48	94	1	37	108	0	18	57	34	18.8
18	2047	173	0	104	68	2	41	123	0	37	37	50	20.8
18	2057	204	4	163	30	3	45	138	1	54	16	66	22.4
18	2067	229	7	207	11	4	47	144	1	62	6	75	23.4
19	2017	183	78	50	48	8	35	213	12	15	43	143	19.3
19	2027	208	92	56	46	12	38	221	13	16	36	156	21
19	2037	227	113	58	39	16	40	224	15	18	28	163	22.6
19	2047	244	136	52	34	20	41	227	18	17	22	170	19.9
19	2057	258	150	57	29	23	42	227	19	18	19	171	17.8
19	2067	259	158	56	23	22	41	209	19	17	19	153	18.9
20	2017	90	20	10	50	10	30	79	3	2	55	20	14.4
20	2027	123	33	4	84	0	37	95	5	2	71	17	17
20	2037	158	40	53	66	1	44	110	5	21	51	34	19.5
20	2047	186	44	72	66	1	48	119	5	24	42	47	21.7
20	2057	206	47	98	59	2	50	124	5	30	32	58	23.7
20	2067	216	55	127	14	3	51	123	6	38	7	64	25.2
21	2017	107	0	0	100	7	31	127	0	0	93	34	12.4
21	2027	151	0	28	113	10	38	147	0	11	81	55	14.8
21	2037	197	0	95	87	13	45	167	0	34	57	75	17
21	2047	231	3	147	61	10	48	173	1	48	37	75	19.2
21	2057	256	27	169	57	3	51	175	5	51	46	73	21.2
21	2067	257	58	165	24	4	50	155	10	48	22	72	23.3
22	2017	136	4	30	87	15	42	190	1	12	77	101	13.9

Unit	YEAR	BA	BA>30"	BA20-30"	BA10-20"	BA<10"	Canopy Cover %	TPA	TPA>30"	TPA20-30"	TPA10-20"	TPA<10"	QMD
22	2027	175	6	65	89	14	48	198	1	23	71	103	15.9
22	2037	204	13	102	72	14	51	196	2	33	54	105	16.6
22	2047	225	35	120	56	13	53	190	6	37	43	104	17.9
22	2057	225	65	111	37	10	53	166	10	34	30	91	19.6
22	2067	225	91	96	26	11	52	152	14	28	20	89	21.4
23	2017	90	0	10	70	10	28	121	0	4	66	51	11.7
23	2027	133	0	13	104	16	37	143	0	4	65	73	14.3
23	2037	180	0	87	66	22	45	164	0	33	37	92	16.6
23	2047	222	8	170	27	15	51	180	2	59	27	92	18.8
23	2057	255	26	195	31	4	55	185	5	59	40	81	20.9
23	2067	274	61	171	31	5	57	179	11	48	31	89	22.4
24	2017	60	10	20	30	0	29	45	2	8	35	0	15.6
24	2027	87	12	26	49	0	39	68	2	8	34	24	19
24	2037	117	15	65	36	1	48	90	2	22	20	47	22.1
24	2047	147	26	105	5	3	57	112	4	35	3	69	24.6
24	2057	177	63	107	1	6	65	133	10	32	0	91	23.9
24	2067	207	98	99	0	10	73	154	15	27	0	113	23.1
25	2017	107	0	0	100	7	27	127	0	0	93	34	12.4
25	2027	151	0	28	113	10	34	147	0	11	81	55	14.8
25	2037	197	0	95	87	13	40	167	0	34	57	75	17
25	2047	231	3	147	61	10	43	173	1	48	37	75	19.2
25	2057	256	27	169	57	3	45	175	5	51	46	73	21.2
25	2067	257	58	165	24	4	44	155	10	48	22	72	23.3
26	2017	62	0	10	45	7	19	142	0	4	52	86	12.8
26	2027	94	0	16	69	5	25	160	0	6	59	94	15.1
26	2037	134	0	58	66	10	32	178	0	21	45	112	16.2
26	2047	174	1	111	45	17	37	195	0	37	28	129	15.8
26	2057	201	11	140	26	20	40	194	2	43	15	131	17.3
26	2067	223	52	133	14	22	42	194	10	40	11	132	18.2
27	2017	179	36	48	88	7	51	164	6	17	73	69	17.6
27	2027	210	40	64	96	7	55	183	6	21	73	82	17.7
27	2037	234	47	90	86	9	59	194	6	29	61	98	19.2
27	2047	250	59	105	71	11	61	199	8	33	47	109	18.5
27	2057	266	71	127	54	14	62	206	9	40	35	121	19.5
27	2067	267	89	123	41	13	62	194	12	38	28	116	20.9
28	2017	162	24	112	24	2	37	168	4	38	26	100	20.7
28	2027	192	38	119	29	6	42	187	6	36	26	120	21.8
28	2037	215	55	116	32	9	44	199	8	31	24	135	21.6
28	2047	232	87	96	34	13	46	202	13	24	21	144	23.3
28	2057	250	131	71	31	17	48	208	20	18	17	153	20.1
28	2067	251	161	48	23	18	47	195	24	13	13	144	20.9
29	2017	168	43	47	67	12	35	140	7	16	54	64	16.3
29	2027	203	56	62	62	15	39	161	9	21	45	84	17.9
29	2037	231	70	87	61	13	42	172	10	28	45	90	19

Unit	YEAR	BA	BA>30"	BA20-30"	BA10-20"	BA<10"	Canopy Cover %	TPA	TPA>30"	TPA20-30"	TPA10-20"	TPA<10"	QMD
29	2047	252	90	101	47	10	44	179	13	33	38	91	20.2
29	2057	271	106	110	44	9	45	185	14	34	38	98	21.5
29	2067	274	128	105	31	9	45	175	17	32	29	98	23
30	2017	47	0	15	15	17	30	84	0	6	13	65	11.8
30	2027	68	6	20	31	11	40	103	1	7	38	57	12.5
30	2037	97	7	31	51	7	53	122	1	9	48	63	14.6
30	2047	128	13	42	60	12	66	140	2	12	43	82	16.7
30	2057	160	36	42	70	11	76	158	6	14	47	90	17.6
30	2067	187	53	78	45	9	84	166	8	28	36	92	18.7
31	2017	140	0	40	80	20	29	153	0	15	87	51	12.9
31	2027	194	0	50	128	12	36	175	0	15	105	47	15.3
31	2037	231	2	113	114	1	39	177	0	37	96	42	17.6
31	2047	260	19	154	85	1	42	177	4	49	67	58	19.9
31	2057	265	55	152	57	2	41	163	10	46	42	66	22.2
31	2067	267	89	128	38	3	41	154	15	38	26	73	24.2
32	2017	62	0	10	45	7	21	142	0	4	52	86	12.8
32	2027	94	0	16	69	5	29	160	0	6	59	94	15.1
32	2037	134	0	58	66	10	36	178	0	21	45	112	16.2
32	2047	174	1	111	45	17	42	195	0	37	28	129	15.8
32	2057	201	11	140	26	20	45	194	2	43	15	131	17.3
32	2067	223	52	133	14	22	48	194	10	40	11	132	18.2
33	2017	189	48	51	59	27	34	333	8	17	51	257	13.5
33	2027	217	66	67	49	33	35	324	10	22	41	251	14.5
33	2037	224	77	74	41	32	35	277	10	23	32	211	15.4
33	2047	222	89	70	31	31	34	227	12	21	23	172	16.3
33	2057	222	103	64	24	30	33	198	13	19	17	148	16.8
33	2067	222	118	53	27	22	33	176	15	15	26	118	18.3
34	2017	148	48	62	37	2	39	88	8	18	30	32	20.5
34	2027	175	66	67	36	4	44	108	10	19	24	53	22.4
34	2037	202	96	70	29	6	48	127	14	21	18	74	24.1
34	2047	229	126	71	23	8	52	148	18	22	14	94	23.8
34	2057	250	146	76	17	10	55	163	20	23	10	108	24
34	2067	265	166	73	14	10	57	171	21	22	12	115	24.7
35	2017	139	56	45	28	10	33	148	9	14	21	104	21.1
35	2027	165	74	52	28	11	37	168	11	17	22	119	23.1
35	2037	193	91	62	26	14	41	188	13	19	20	136	17.6
35	2047	218	107	72	20	19	44	205	14	22	15	154	17.1
35	2057	241	123	72	18	26	46	217	15	21	13	168	18.3
35	2067	260	143	69	16	31	48	222	17	19	12	173	19
36	2017	164	49	68	39	6	33	239	8	22	35	174	20.5
36	2027	193	63	72	42	14	37	253	9	22	32	189	22.2
36	2037	215	81	79	37	17	39	262	11	24	28	198	21.6
36	2047	234	97	86	30	22	41	264	13	26	21	204	19.3
36	2057	252	112	87	24	27	42	266	14	26	16	210	15.9

Unit	YEAR	BA	BA>30"	BA20-30"	BA10-20"	BA<10"	Canopy Cover %	TPA	TPA>30"	TPA20-30"	TPA10-20"	TPA<10"	QMD
36	2067	266	134	80	19	33	43	265	17	23	12	213	16.5
37	2017	166	53	61	38	14	39	179	9	19	36	115	15
37	2027	200	63	70	50	17	44	200	9	20	41	129	16.4
37	2037	228	84	71	49	22	46	210	12	20	36	142	17.5
37	2047	248	108	74	39	25	48	212	15	22	28	145	18.7
37	2057	268	135	71	34	24	49	215	19	22	27	144	19
37	2067	268	152	67	30	19	48	194	20	21	29	124	20.3
49	2017	148	48	62	37	2	60	88	8	18	30	32	20.5
49	2027	175	66	67	36	4	67	108	10	19	24	53	22.4
49	2037	202	96	70	29	6	73	127	14	21	18	74	24.1
49	2047	229	126	71	23	8	79	148	18	22	14	94	23.8
49	2057	250	146	76	17	10	84	163	20	23	10	108	24
49	2067	265	166	73	14	10	86	171	21	22	12	115	24.7
50	2017	110	15	30	40	25	33	115	2	9	47	57	13.3
50	2027	136	22	35	76	4	38	133	3	11	90	29	14.9
50	2037	163	25	36	101	1	43	151	3	10	97	41	16.4
50	2047	191	31	44	110	2	47	167	4	13	89	60	18
50	2057	211	43	59	101	4	49	176	6	19	73	76	19.4
50	2067	225	56	75	86	5	51	181	7	25	59	89	19.9
52	2017	183	78	50	48	8	46	213	12	15	43	143	19.3
52	2027	208	92	56	46	12	49	221	13	16	36	156	21
52	2037	227	113	58	39	16	52	224	15	18	28	163	22.6
52	2047	244	136	52	34	20	53	227	18	17	22	170	19.9
52	2057	258	150	57	29	23	54	227	19	18	19	171	17.8
52	2067	259	158	56	23	22	54	209	19	17	19	153	18.9

Current Conditions Threat Zone

Unit	Acres	Basal Area					LiDAR Canopy Cover %	Trees per Acre					QMD	SDI
		Total	≥30" DBH	20"-29.9" DBH	10"-19" DBH	<10" DBH		Total	≥30" DBH	20"-29.9" DBH	10"-19" DBH	<10" DBH		
16	3.9	221	15	155	35	16	34	155	2	35	51	66	17.6	323
18	18.2	80	0	0	80	0	28	79	0	0	79	0	13.7	184
19	37.7	183	78	50	48	8	35	213	12	15	43	143	19.3	286
20	27.2	90	20	10	50	10	30	79	3	2	55	20	14.4	198
21	27.1	107	0	0	100	7	31	127	0	0	93	34	12.4	204
22	300	136	4	30	87	15	42	190	1	12	77	101	13.9	261
24	28.5	60	10	20	30	0	29	45	2	8	35	0	15.6	94
25	2.2	107	0	0	100	7	27	127	0	0	93	34	12.4	204
26	36.9	62	0	10	45	7	19	142	0	4	52	86	12.8	129
27	62	179	36	48	88	7	51	164	6	17	73	69	17.6	282
28	21.6	162	24	112	24	2	37	168	4	38	26	100	20.7	244
29	93.7	168	43	47	67	12	35	140	7	16	54	64	16.3	256
30	2	47	0	15	15	17	30	84	0	6	13	65	11.8	101
31	14.1	140	0	40	80	20	29	153	0	15	87	51	12.9	249
32	20.5	62	0	10	45	7	21	142	0	4	52	86	12.8	129
33	180.4	189	48	51	59	27	34	333	8	17	51	257	13.5	379
34	165.5	148	48	62	37	2	39	88	8	18	30	32	20.5	224
35	79.5	139	56	45	28	10	33	148	9	14	21	104	21.1	198
36	164.7	164	49	68	39	6	36	239	8	22	35	174	20.5	246
37	194.5	166	53	61	38	14	39	179	9	19	36	115	15	267
50	20.6	110	15	30	40	25	33	115	2	9	47	57	13.3	204

POST TREATMENT THREAT ZONE

Unit	Basal Area After	Canopy Cover After	Trees per Acre After	QMD After	SDI After
16	93	34	43	20	130
18	80	28	79	14	184
19	98	19	37	22	135
20	72	30	47	17	150
21	94	31	83	15	174
22	80	26	41	19	138
24	60	29	45	16	94
25	94	27	83	15	174
26	56	19	65	13	112
27	172	51	95	18	264
28	79	20	40	19	113
29	90	21	41	20	126
30	32	30	26	15	60
31	122	29	107	14	210
32	56	21	65	13	112
33	99	20	61	17	172
34	87	24	30	23	125
35	86	20	33	22	111
36	94	22	48	19	130
37	94	23	42	20	137
50	85	33	58	16	146

50-YEAR PROJECTIONS: THREAT ZONE

Unit	YEAR	BA	BA > 30"	BA 20-30"	BA 10-20"	BA <10"	Canopy Cover %	TPA	TPA > 30"	TPA 20-30"	TPA 10-20"	TPA< 10"	QMD	SDI
16	2017	221	15	155	35	16	34	155	2	35	51	66	17.6	323
16	2027	100	83	4	12	0	36	161	15	1	11	134	26	131
16	2037	118	95	6	14	2	37	181	15	2	10	155	27.9	157
16	2047	140	107	13	11	9	36	201	15	4	7	175	29.8	193
16	2057	163	119	16	10	18	36	221	15	5	5	195	22.6	227
16	2067	189	130	28	2	28	36	239	15	9	2	212	16.1	265
18	2017	80	0	0	80	0	28	79	0	0	79	0	13.7	184
18	2027	91	0	8	83	0	28	163	0	3	59	102	16.4	195
18	2037	122	0	42	74	2	35	177	0	15	44	116	19	251
18	2047	154	0	95	50	6	41	191	0	33	26	130	21.2	311
18	2057	185	4	147	23	10	45	201	1	47	12	142	22	364
18	2067	211	46	150	1	15	48	204	9	48	0	146	20	407
19	2017	183	78	50	48	8	35	213	12	15	43	143	19.3	286
19	2027	108	86	12	9	1	20	151	12	4	6	129	29.8	145
19	2037	123	99	14	7	3	24	170	13	4	5	148	30	167
19	2047	141	110	17	5	9	28	188	13	5	3	167	30.9	199
19	2057	160	120	21	3	16	31	206	13	6	2	185	25.6	230
19	2067	181	131	22	2	26	33	224	14	7	2	201	16.9	264
20	2017	90	20	10	50	10	30	79	3	2	55	20	14.4	198
20	2027	68	34	3	31	0	37	125	5	1	20	99	21.8	128
20	2037	85	39	29	16	2	44	139	5	11	10	114	24.3	161
20	2047	105	43	42	13	7	48	154	5	13	7	128	26.4	203
20	2057	125	48	59	5	13	50	167	5	18	2	142	21.2	242
20	2067	147	56	69	1	21	51	181	6	19	1	155	15.8	286
21	2017	107	0	0	100	7	31	127	0	0	93	34	12.4	204
21	2027	116	0	26	81	0	38	194	0	10	56	124	17.3	199
21	2037	154	0	88	60	2	45	212	0	31	37	142	20	256
21	2047	193	1	144	40	7	48	228	0	46	22	159	22.2	314
21	2057	222	29	155	26	11	51	231	6	46	14	165	23.4	353
21	2067	248	69	153	9	16	50	229	12	44	5	168	21.6	384
22	2017	136	4	30	87	15	42	190	1	12	77	101	13.9	261
22	2027	100	6	65	29	0	30	157	1	22	15	119	21.9	163
22	2037	126	12	108	3	2	37	176	2	35	1	138	24.5	202
22	2047	155	38	107	1	8	43	194	7	31	0	156	26.8	248
22	2057	178	70	94	0	13	47	201	11	25	0	165	25.1	281
22	2067	196	111	65	0	19	49	201	17	16	0	167	19.4	306

Unit	YEAR	BA	BA > 30"	BA 20-30"	BA 10-20"	BA <10"	Canopy Cover %	TPA	TPA > 30"	TPA 20-30"	TPA 10-20"	TPA< 10"	QMD	SDI
24	2017	60	10	20	30	0	29	45	2	8	35	0	15.6	94
24	2027	76	12	24	40	0	39	175	2	8	28	138	19.4	111
24	2037	105	14	60	27	3	48	195	2	20	15	159	22.6	151
24	2047	135	28	86	4	10	57	215	4	27	2	179	24.4	196
24	2057	168	55	93	1	20	65	235	9	27	0	199	20	241
24	2067	203	91	81	2	30	73	254	14	22	2	216	15.3	289
25	2017	107	0	0	100	7	27	127	0	0	93	34	12.4	204
25	2027	116	0	26	81	0	34	194	0	10	56	124	17.3	199
25	2037	154	0	88	60	2	40	212	0	31	37	142	20	256
25	2047	193	1	144	40	7	43	228	0	46	22	159	22.2	314
25	2057	222	29	155	26	11	45	231	6	46	14	165	23.4	353
25	2067	248	69	153	9	16	44	229	12	44	5	168	21.6	384
26	2017	62	0	10	45	7	19	142	0	4	52	86	12.8	129
26	2027	66	0	14	49	0	25	162	0	5	36	119	16.7	123
26	2037	95	0	52	39	3	32	179	0	19	23	136	19.6	171
26	2047	127	2	103	13	9	37	196	0	34	8	154	21.7	226
26	2057	159	11	122	8	17	40	212	2	35	5	170	19.6	277
26	2067	189	56	100	6	24	42	220	10	27	5	177	16.1	323
27	2017	179	36	48	88	7	51	164	6	17	73	69	17.6	282
27	2027	171	39	60	69	0	55	209	6	20	50	132	20.2	253
27	2037	197	47	82	66	2	59	227	6	26	43	152	21.8	288
27	2047	220	58	101	51	6	61	237	8	32	31	165	23.3	320
27	2057	238	72	119	36	10	62	240	9	37	21	172	24.6	343
27	2067	255	91	119	28	15	62	244	12	36	15	180	22.9	364
28	2017	162	24	112	24	2	37	168	4	38	26	100	20.7	244
28	2027	90	31	48	11	1	22	164	4	14	9	137	24.3	126
28	2037	108	42	48	14	3	28	184	6	12	9	157	26.3	153
28	2047	130	68	33	14	10	32	204	10	9	7	177	26.1	189
28	2057	153	100	32	2	19	36	223	15	11	1	196	20.6	226
28	2067	180	116	31	3	30	40	243	16	10	3	214	14.8	267
29	2017	168	43	47	67	12	35	140	7	16	54	64	16.3	256
29	2027	102	51	27	23	1	23	170	8	9	15	139	23.2	138
29	2037	123	62	40	18	3	28	191	8	13	11	158	25.1	168
29	2047	148	73	56	10	10	32	211	9	18	6	178	27	206
29	2057	173	88	64	3	17	36	230	11	19	3	197	23.1	243
29	2067	200	108	58	4	27	39	246	13	16	4	213	16.2	282
30	2017	47	0	15	15	17	30	84	0	6	13	65	11.8	101
30	2027	38	5	19	14	1	40	134	1	6	11	115	18.5	69

Unit	YEAR	BA	BA > 30"	BA 20-30"	BA 10-20"	BA <10"	Canopy Cover %	TPA	TPA > 30"	TPA 20-30"	TPA 10-20"	TPA< 10"	QMD	SDI
30	2037	53	8	27	15	3	53	151	1	8	10	132	21.4	97
30	2047	73	17	32	12	11	66	167	3	9	7	148	19.8	136
30	2057	96	40	28	7	21	76	184	7	9	5	163	13.7	181
30	2067	122	50	33	8	30	84	200	7	10	10	172	12.6	229
31	2017	140	0	40	80	20	29	153	0	15	87	51	12.9	249
31	2027	150	0	46	104	0	36	222	0	14	77	131	17.3	242
31	2037	195	3	107	83	2	39	243	1	36	55	152	19.7	304
31	2047	229	30	130	57	6	42	245	6	42	35	160	21.9	349
31	2057	257	58	153	36	10	41	242	10	47	21	163	23.8	381
31	2067	269	88	143	24	12	41	224	15	41	13	155	23.5	388
32	2017	62	0	10	45	7	21	142	0	4	52	86	12.8	129
32	2027	66	0	14	49	0	29	162	0	5	36	119	16.7	123
32	2037	95	0	52	39	3	36	179	0	19	23	136	19.6	171
32	2047	127	2	103	13	9	42	196	0	34	8	154	21.7	226
32	2057	159	11	122	8	17	45	212	2	35	5	170	19.6	277
32	2067	189	56	100	6	24	48	220	10	27	5	177	16.1	323
33	2017	189	48	51	59	27	34	333	8	17	51	257	13.5	379
33	2027	113	61	28	19	3	21	158	9	9	15	126	22.3	188
33	2037	133	71	40	16	5	24	174	10	12	11	142	22.7	222
33	2047	155	84	48	12	10	27	191	11	15	9	157	23.8	264
33	2057	175	99	50	9	15	29	198	12	15	8	162	23.7	296
33	2067	191	115	46	11	18	31	199	14	13	11	161	20.2	322
34	2017	148	48	62	37	2	39	88	8	18	30	32	20.5	224
34	2027	99	59	27	13	0	27	152	8	8	8	128	27.1	137
34	2037	117	77	30	7	2	33	171	11	9	4	147	29.1	163
34	2047	137	93	33	3	9	39	189	12	10	2	165	30.7	197
34	2057	159	107	34	1	16	43	207	13	10	1	184	24.6	230
34	2067	182	125	30	1	26	48	225	15	8	1	201	16.5	268
35	2017	139	56	45	28	10	33	148	9	14	21	104	21.1	198
35	2027	97	66	22	8	1	22	163	9	7	6	141	28.1	121
35	2037	114	78	27	5	3	27	184	10	8	3	163	28.7	145
35	2047	135	89	31	3	11	32	205	11	9	2	183	30.2	179
35	2057	158	107	28	2	19	36	225	13	8	2	202	22.7	212
35	2067	183	125	24	3	30	39	244	15	6	4	219	15.1	250
36	2017	164	49	68	39	6	36	239	8	22	35	174	20.5	246
36	2027	102	59	30	13	1	23	163	8	9	9	136	26.3	136
36	2037	118	71	34	10	3	27	183	10	10	7	156	27.3	160
36	2047	138	82	37	8	10	31	202	10	11	5	176	28	193

Unit	YEAR	BA	BA > 30"	BA 20-30"	BA 10-20"	BA <10"	Canopy Cover %	TPA	TPA > 30"	TPA 20-30"	TPA 10-20"	TPA< 10"	QMD	SDI
36	2057	159	97	38	5	18	35	221	12	11	4	195	22.3	225
36	2067	183	115	33	5	29	38	243	14	9	4	215	15.4	264
37	2017	166	53	61	38	14	39	179	9	19	36	115	15	267
37	2027	105	60	28	16	1	25	160	9	8	12	131	24.6	148
37	2037	124	77	29	15	3	30	179	11	9	9	150	26.4	176
37	2047	146	92	35	9	9	34	197	12	11	6	168	27.9	213
37	2057	169	108	40	5	16	38	215	14	12	5	184	24	248
37	2067	193	123	40	5	25	41	232	15	11	4	201	17.1	285
50	2017	110	15	30	40	25	33	115	2	9	47	57	13.3	204
50	2027	83	21	30	32	0	38	162	3	9	29	120	19.2	135
50	2037	101	26	31	41	2	43	179	3	9	28	139	21.1	165
50	2047	123	34	40	40	9	47	197	5	12	23	157	22.8	205
50	2057	146	45	61	24	16	49	214	6	20	13	174	19.3	245
50	2067	172	59	73	12	26	51	232	8	24	7	192	14.9	289

CURRENT CONDITIONS DEFENSE ZONE

Unit	Acres	Basal Area					LiDAR Canopy Cover %	Trees per Acre					QMD	SDI
		Total	≥ 30" DBH	20"-29.9" DBH	10"-19" DBH	<10" DBH		Total	≥30" DBH	20"-29.9" DBH	10"-19" DBH	<10" DBH		
15	4.4	183	78	50	48	8	42	213	12	15	43	143	19.3	286
16	48.1	221	15	155	35	16	34	155	2	35	51	66	17.6	323
17	16.4	100	0	0	80	20	51	158	0	0	84	75	10.8	215
18	1.3	80	0	0	80	0	28	79	0	0	79	0	13.7	184
19	127.4	183	78	50	48	8	35	213	12	15	43	143	19.3	286
22	0.7	136	4	30	87	15	42	190	1	12	77	101	13.9	261
23	28.5	90	0	10	70	10	28	121	0	4	66	51	11.7	161
25	35	107	0	0	100	7	27	127	0	0	93	34	12.4	204
28	31.6	162	24	112	24	2	37	168	4	38	26	100	20.7	244
29	44.2	168	43	47	67	12	35	140	7	16	54	64	16.3	256
30	38.3	47	0	15	15	17	30	84	0	6	13	65	11.8	101
32	10.4	62	0	10	45	7	21	142	0	4	52	86	12.8	129
34	71	148	48	62	37	2	39	88	8	18	30	32	20.5	224
35	51.1	139	56	45	28	10	33	148	9	14	21	104	21.1	198
37	45.2	166	53	61	38	14	39	179	9	19	36	115	15	267
49	3.5	148	48	62	37	2	60	88	8	18	30	32	20.5	224
52	1.1	183	78	50	48	8	46	213	12	15	43	143	19.3	286

POST TREATMENT DEFENSE ZONE

Unit	Basal Area After	Canopy Cover After %	Trees per Acre After	QMD After	SDI After
15	173	42	65	22	256
16	89	34	18	30	114
17	60	51	47	15	116
18	80	28	79	14	184
19	95	18	16	33	125
22	70	22	33	20	118
23	80	28	70	15	137
25	93	27	81	15	172
28	96	23	25	27	132
29	81	18	18	28	104
30	30	30	19	17	56
32	55	21	56	13	110
34	83	21	16	31	111
35	94	21	20	29	117
37	88	21	18	30	119
49	146	60	55	22	217
52	173	46	65	22	256

50-YEAR PROJECTIONS: DEFENSE ZONE

Unit	YEAR	BA	BA>30"	BA20-30"	BA10-20"	BA<10"	Canopy Cover %	TPA	TPA>30"	TPA20-30"	TPA10-20"	TPA<10"	QMD	SDI
15	2017	183	78	50	48	8	42	213	12	15	43	143	19.3	286
15	2027	189	91	58	40	0	45	80	13	17	29	21	24.3	273
15	2037	214	116	60	36	1	47	100	16	18	24	42	26	303
15	2047	230	140	57	28	2	49	114	19	18	17	59	27.6	320
15	2057	243	155	63	21	3	50	127	20	20	12	75	29.2	334
15	2067	253	168	65	15	5	49	137	20	20	8	89	29.8	345
16	2017	221	15	155	35	16	34	155	2	35	51	66	17.6	323
16	2027	100	100	0	0	0	36	41	18	0	0	23	32.1	126
16	2037	113	112	0	0	1	37	63	18	0	0	45	34.2	141
16	2047	126	123	0	0	3	36	83	18	0	0	65	35.7	157
16	2057	140	134	0	0	6	36	101	17	0	0	84	29.2	174
16	2067	155	145	0	0	10	36	119	17	0	0	102	24	194
17	2017	100	0	0	80	20	51	158	0	0	84	75	10.8	215
17	2027	79	0	15	63	0	61	60	0	7	34	20	18.9	140
17	2037	105	0	98	7	1	69	79	0	37	3	39	21.9	179
17	2047	131	0	129	0	3	74	98	0	40	0	58	24.3	215
17	2057	158	17	136	0	5	77	116	3	36	0	77	23.9	253
17	2067	188	88	92	0	8	77	133	16	23	0	95	23.7	293
18	2017	80	0	0	80	0	28	79	0	0	79	0	13.7	184
18	2027	91	0	8	83	0	33	79	0	3	59	18	16.4	195
18	2037	120	0	42	73	1	37	95	0	15	43	34	19	244
18	2047	146	0	93	51	2	41	109	0	33	27	50	21.1	287
18	2057	174	4	146	21	3	45	124	1	47	11	65	22.5	332
18	2067	203	22	168	4	6	47	139	4	51	2	81	22.8	378
19	2017	183	78	50	48	8	35	213	12	15	43	143	19.3	286
19	2027	104	92	11	0	0	20	37	13	3	0	22	35.3	134
19	2037	114	111	1	0	1	21	58	15	0	0	43	37.1	146
19	2047	125	122	0	0	3	23	78	15	0	0	63	38.1	161
19	2057	137	131	0	0	6	26	98	15	0	0	84	31	177
19	2067	149	139	0	0	10	28	118	15	0	0	103	25.2	195
22	2017	136	4	30	87	15	42	190	1	12	77	101	13.9	261
22	2027	87	6	64	16	0	27	52	1	22	8	21	22.6	140
22	2037	109	18	89	1	1	32	72	3	28	0	41	25.3	169
22	2047	131	41	87	0	3	37	91	7	24	0	61	27.7	199
22	2057	153	77	71	0	5	41	111	12	18	0	80	26.1	229
22	2067	175	111	53	0	9	45	129	17	13	0	99	23.7	259
23	2017	90	0	10	70	10	28	121	0	4	66	51	11.7	161
23	2027	106	0	12	95	0	37	86	0	4	59	23	17.6	169
23	2037	145	1	94	49	1	45	108	0	36	26	45	20.6	218
23	2047	184	8	162	8	3	51	129	2	55	4	67	23.2	266

Unit	YEAR	BA	BA>30"	BA20-30"	BA10-20"	BA<10"	Canopy Cover %	TPA	TPA>30"	TPA20-30"	TPA10-20"	TPA<10"	QMD	SDI
23	2057	221	29	186	0	5	55	150	5	55	0	89	24.5	311
23	2067	252	71	163	0	8	57	164	12	44	0	105	24.3	345
25	2017	107	0	0	100	7	27	127	0	0	93	34	12.4	204
25	2027	115	0	26	80	0	34	91	0	10	55	21	17.4	198
25	2037	152	0	88	60	1	40	111	0	31	36	42	20.1	248
25	2047	188	2	142	39	2	43	130	1	45	21	62	22.4	296
25	2057	219	34	163	17	4	45	145	6	50	9	80	24.1	335
25	2067	242	61	164	10	6	44	154	10	46	5	92	24.2	362
28	2017	162	24	112	24	2	37	168	4	38	26	100	20.7	244
28	2027	108	38	70	0	0	25	47	6	19	0	23	28.6	144
28	2037	123	57	65	0	1	28	69	9	15	0	45	30.6	162
28	2047	139	101	35	0	3	31	90	16	8	0	67	32.4	181
28	2057	154	138	11	0	6	34	111	21	2	0	88	28.7	202
28	2067	171	160	0	0	10	37	132	23	0	0	109	24.8	224
29	2017	168	43	47	67	12	35	140	7	16	54	64	16.3	256
29	2027	90	56	34	0	0	20	41	9	9	0	23	30.6	113
29	2037	102	72	28	0	1	23	64	10	7	0	46	32.6	128
29	2047	115	92	20	0	3	25	86	13	5	0	69	33.9	144
29	2057	129	109	13	0	7	28	108	14	3	0	91	26.5	162
29	2067	144	128	5	0	12	31	129	16	1	0	112	22	183
30	2017	47	0	15	15	17	30	84	0	6	13	65	11.8	101
30	2027	35	6	19	10	0	40	35	1	7	8	20	20.6	62
30	2037	47	8	28	10	1	53	54	1	8	6	39	23.6	79
30	2047	59	19	28	7	4	66	72	3	8	4	57	22.2	99
30	2057	73	43	16	6	8	76	90	7	5	3	75	18.8	123
30	2067	90	55	20	3	12	84	107	8	6	3	90	17.7	151
32	2017	62	0	10	45	7	21	142	0	4	52	86	12.8	129
32	2027	65	0	17	49	0	29	63	0	7	36	20	16.8	121
32	2037	91	0	52	37	1	36	81	0	19	22	40	19.9	160
32	2047	118	5	96	15	3	42	100	1	31	9	59	22.5	200
32	2057	145	18	113	9	5	45	118	3	32	5	77	22.1	238
32	2067	172	50	108	6	9	48	136	9	28	3	95	21.8	277
34	2017	148	48	62	37	2	39	88	8	18	30	32	20.5	224
34	2027	92	68	24	0	0	24	37	10	5	0	22	33	121
34	2037	104	97	5	0	1	27	58	14	1	0	43	35.1	135
34	2047	116	113	0	0	3	30	79	15	0	0	64	36.9	151
34	2057	129	124	0	0	6	33	99	15	0	0	84	28.6	168
34	2067	143	133	0	0	10	37	119	15	0	0	104	23.9	188
35	2017	139	56	45	28	10	33	148	9	14	21	104	21.1	198
35	2027	105	73	32	0	0	23	43	11	9	0	24	31.6	127
35	2037	118	91	26	0	1	25	66	12	7	0	47	33.6	142
35	2047	132	109	20	0	3	28	89	14	5	0	70	35.4	158
35	2057	146	128	12	0	6	31	111	16	3	0	92	28.6	177
35	2067	162	148	3	0	11	34	133	18	1	0	114	23.9	197

Unit	YEAR	BA	BA>30"	BA20-30"	BA10-20"	BA<10"	Canopy Cover %	TPA	TPA>30"	TPA20-30"	TPA10-20"	TPA<10"	QMD	SDI
37	2017	166	53	61	38	14	39	179	9	19	36	115	15	267
37	2027	97	63	35	0	0	23	39	9	8	0	22	31.9	129
37	2037	109	88	20	0	1	26	60	13	5	0	43	33.9	144
37	2047	122	112	7	0	3	28	81	16	2	0	64	35.7	160
37	2057	135	128	2	0	6	31	102	17	0	0	85	28.5	178
37	2067	149	138	1	0	10	34	121	17	0	0	105	23.9	197
49	2017	148	48	62	37	2	60	88	8	18	30	32	20.5	224
49	2027	163	65	64	32	0	67	72	10	18	21	22	24.4	234
49	2037	187	94	64	26	1	73	92	14	19	16	43	26.4	263
49	2047	210	123	66	19	2	79	111	17	20	11	63	28.1	291
49	2057	235	145	72	14	4	84	133	20	21	8	84	29.6	322
49	2067	254	167	74	6	6	86	148	21	22	3	101	28.8	345
52	2017	183	78	50	48	8	46	213	12	15	43	143	19.3	286
52	2027	189	91	58	40	0	49	80	13	17	29	21	24.3	273
52	2037	214	116	60	36	1	52	100	16	18	24	42	26	303
52	2047	230	140	57	28	2	53	114	19	18	17	59	27.6	320
52	2057	243	155	63	21	3	54	127	20	20	12	75	29.2	334
52	2067	253	168	65	15	5	54	137	20	20	8	89	29.8	345